Role of 360-Degree Virtual Reality Tours for Real Estate

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ABSTRACT

360-degree video is gaining popularity because it is immersive and participatory. However, little is known about the opinions and attitudes of the general people regarding the application of this cutting-edge technology in real estate. The research supporting 360-degree property tours, buyer seller interactions is reviewed in this study along with studies that are related to them. Additionally, survey analysis, methodology and tools are described, along with the outcomes that were obtained. The use of VR tours in real estate platform is discussed, and suggestions are made for further study. The study's key findings, which are based on survey conducted, demonstrate that 360° video and its use in real estate platforms are well recognized by the general public, who mostly express anticipation, trust, and excitement when discussing it. However, property owners lack the technical know-how to create 360-degree tours. Finally, 360-degree property tours has been shown to be a successful tool that meets the requirements of new age buyers and sellers on real estate platforms.

General Terms

Virtual Reality; 360 degree.

Keywords

Virtual Reality; 360-Degree; Real Estate; Statistical Tests; Virtual Tour; Survey.

1. INTRODUCTION

The ambition of photographers to present more information or a deeper picture of cities and landscapes has risen since the introduction of photography in the 19th century. Wide angle lenses, able to record nearly 180-degree views of the surroundings, were made possible as a result. People started taking 180-degree panoramas. Later, as a result of this advancement, 360-degree panoramas could be taken. These panoramas, which could be seen as an extension of 180-degree panoramas, provide a 360-degree horizontal picture of is a seamless view. It enables users to record their entire environment at any time. The images are saved as JPG or your surroundings.

We now live in a time when 360-degree surround photography, or photospheres, is the newest style of photography due to improvements in hardware and

image processing. Users using photospheres can take a single point of view of the entire surrounding area. This provides a full 360° vision horizontally and a full 180° view vertically, giving the user the option to freely rotate

their head and body as they see fit. Another name for this PNG files with a width to height ratio of 2:1. Android smartphones already have the built-in capability to capture photospheres and

the emergence of 360 cameras such as Insta 360 and GoPro 360 has made the process of capturing photospheres even easier. Additionally, websites like Marzipano process panoramas made with various cameras. A virtual tour application that can be installed on any web hosting platform can be exported after processing. The users of this virtual tour experience may find it quite useful to travel while remaining in one location. There are numerous applications for it, such as virtual tours of historical sites or of real estate that is up for sale.

People who take virtual reality tours can see themselves in the setting, giving them a sense of security and letting them know exactly what they are getting into. This helps them make a more informed decision about whether to buy the property or not. In particular with real estate 360 tours, it gives them a sense of ownership. They always welcome all potential buyers and offer a perpetual open house experience in real estate. According to a recent analysis, using 360-degree tours can boost hotel bookings by up to 16%. [1]. We have put this concept into practice on our real estate website VRDoor.

The remainder of this paper discusses recent relevant work in Section 2; techniques used in Section 3; the user interface of the study is presented in Section 4; Survey analysis is given in Section 5; Finally, Section 6 presents a summary of the key findings and conclusion, examines their implications and limitations, and offers suggestions for further study.

2. LITERATURE REVIEW

Vidanapathirana et al. [1], this paper introduces the Photosphere to Cognition Engine (P2CE), a novel and creative method that enables cognitive analysis on 360-degree surround photographs utilising current image cognitive analysis algorithms and APIs created for conventional photos.

Banchi et al. [2], the author compares the user experiences of different virtual reality (VR) image formats, such as stereoscopic 180-degree, monoscopic 180-degree, and stereoscopic 360- degree images. Stereoscopic 360-degree images received the highest ratings based on the results of the subjective indices (reality, presence, and depth sensation).

Jokela et al. [3] The authors explored the opportunities, difficulties, and constraints of using a 360-degree camera in comparison to using conventional cameras while also describing the techniques the participants used to record 360-degree content in various contexts. Panorama Capture, Experience Capture, Automatic Capture, and Document Capture were found to be the four most prevalent consumer 360-degree camera usage techniques. Additionally, they discussed the participants' viewing, sharing, editing, and management practises for 360-degree consumer- generated content.

Pan [4] In this paper, author focus on a realistic analysis of the interaction between augmented reality and virtual reality under the background of VR. This work adds to the body of knowledge on virtual reality visual presentation, offers direction to those who practise virtual reality design, and has potential value and applications in real life.

Mitra et al. [5] The author of this paper proposed a platform that had been designed using open source Marzipano tool to create virtual model. In this platform environment suitable panoramic images with 360-degree orientation are supplied and then interconnected together to form the virtual experience.

Pereira et al. [6] In this paper the author creates a 360-degree panoramic virtual reality environment using a series of panoramic videos and photos. The author also discusses the procedure of creating this experience, the process of augmenting the captured panoramas with different layers of information.

Pirker and Dengel [7] In this article, the authors discussed the technological benefits, advantages and limitation of VR in education and other use cases. They also identify the open research gap in use cases for real VR.

Krasnov [8] The author through this paper educate marketers on what virtual reality is and how they can use it for getting results and what the future holds with virtual reality.

Sulaiman et al. [9] This paper talks about the problems faced by the real estate business during pandemic COVID-19, and also draws a comparison between conventional approached and virtual tours as a marketing strategy to sell the property on various themes including visual experience and accessibility. The paper explains Matterport as a new platform for the marketing approach.

Lampropoulos et al. [10] In this paper, the authors studied the data from the last 10 years and found 360-degree video is proven to be an effective educational tool and was recognized positively by the public. Nonetheless, they found that the teachers did not have the technical skills to develop 360-degree educational videos.

Pleyers and Poncin [11] This paper draws a comparison between the customer experience and attitude when customers where showed static images versus when they were shown interactive 360-degree images. It concluded that the latter was associated with better "visiting" experiences and more positive attitudes toward both the products and the agency. This study emphasises how these technologies might improve client attitudes and experiences, especially in the fiercely competitive real estate market.

Meyer et al. [12] investigated the effect of pre- training when learning through immersive virtual reality and video. The authors did study on 118 participants to test the effect of pre training. They were assigned one method condition out of with or without pretraining and one media condition out of immersive VR or video. The authors concluded that pretraining had a positive impact on knowledge, transfer, and self-efficacy directly following the intervention. The video condition did not show any effect for any of these variables.

Southgate et al. [13] Working with low-income high schools, they investigated the moral and security ounding the use of immersive virtual reality in the classroom, how to navigate the concerns surrounding the use of immersive virtual reality in the classroom, how to navigate the organisational structure of a school system and find solutions in the face of institutional internet access restrictions, and educational reflections on group work and gender dynamics. After VR was implemented in schools, kids saw learning benefits.

Du and Zhou [14] developed a real estate virtual display system with using AutoCAD, 3Ds MAX and virtual reality engine VPR-platform. The main purpose of this system was to attract the potential customers and show them the realistic view of the system. The authors interacted with the 30 users of the system to know their satisfaction.

Pleyers and Poncin [15] provided a non- immersive VR experience by providing 360 degree view for better experience. The authors highlighted the advantages of using such technologies for better customer satisfaction in real estate business.

Tikhon P. Podshivalov [16] suggested the use of block chain technology to modernise the real estate turnover and registration of property rights. The author also suggested using augmented reality and virtual reality in real estate accounting.

3. BRIEF OF TECHNOLOGIES USED

The technologies used is explained briefly in this section.

Marzipano is an open source tool for creating virtual reality 360 panoramic image platforms, licensed under the Apache 2.0 license. ReactJS, an open-source JavaScript library, is used to design a web portal for accessing the platform and its various modules.

The Insta 360 camera is used to capture and collect 360 panoramic images for the platform.

NodeJS and ExpressJS are used to develop a server which is hosted on a physical or cloud- based server, such as AWS or GCP.

Firebase is used to store the images on a cloud platform.

The platform is accessible online and is housed on a virtual server in the cloud. Elastic Compute Cloud from Amazon Web Services serves as one of its cloud service providers, and it is hosted on Netlify, a popular free hosting service provider.

The IP address of the server must be associated with a domain name through a Domain Name System provider in order for the server to be reachable from the internet. For this, we use Amazon Route 53.

The panoramic image is rendered into a virtual environment module project using the Marzipano tool. To create a transitional experience, the scenes in the virtual reality project might also be connected to one another.

Jitsi Meet is used to provide a two-way interactive experience.

4. PROPOSED WORK

VR DOOR is a real estate platform that aims to bring the best features of a traditional real estate agency and a virtual reality tour. The home page of the project is shown in figure 2. The platform has an AI chat bot that can answer questions about the property and direct users to the property in VR. The user will be able to see photos, floor plans, and other details about a property before they book it.

The platform also has virtual reality setups so that people can view properties in VR while they walk through them. This would allow them to feel as though they are walking through a home instead of just looking at photos on their screen.

The integrated platform for virtual meetings will allow users to schedule meetings with each other without leaving their office or hotel room. The platform also has a feature that allows it to calculate EMI based on the value of the property being sold or leased. The unique feature of the work is the inclusion of 360-degree VR tour for the real estate. 360 degree panorma is shown in Fig 1. The home page of the project is shown in Fig 2.
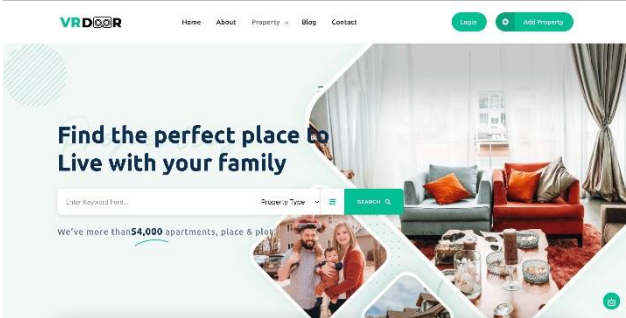
Fig 1: 360 Degree Panorma

Fig 2: Home Page of the Project

5. SURVEY ANALYSIS

The purpose of this survey was to understand how useful and beneficial VR tours would be for real estate platforms. To accomplish this, we surveyed a total of about 150 property sellers and buyers in an attempt to gain insight into their opinions on the subject.

5.1 Methodology

The methodology used to conduct this survey was as follows: An email was sent to all property sellers and buyers who had posted a listing on popular real estate platforms within the last 90 days. The email included a link to a survey form and asked for their opinion about how useful VR tours would be in real estate platforms. The survey was open to anyone interested in real estate and had no restrictions on location, age, or gender. The survey consisted of a set of structured questions designed to elicit responses on the usefulness of virtual tours, their impact on the industry, and the factors that influence their adoption. About 15 questions were there in the survey. Participants were asked to select a number from 1 to 5, with 1 indicating "strongly disagree" and 5 indicating "strongly agree."

5.2 Statistical Analysis of the Survey Data

Quantitative judgements can be made using statistical tests. They aid in confirming our findings even further. The survey data collected from the respondents was subjected to statistical testing. The labels given to each of the study's components are listed in Table 1. Table 2 shows the summary of responses in percentage for each survey statement where, A is "Strongly Disagree", B is "Somewhat Disagree", C is "Neither Disagree nor Agree", D is "Somewhat Agree", E is "Strongly Agree" . To get a better understanding of the variability in the responses, we also calculated the standard deviation. Finally, standard deviation was used to generate a confidence interval for mean. A confidence interval is a range of values that we can be reasonably confident contains the true population mean. In conducting surveys, it is essential to receive a high response rate to ensure the data collected is representative and accurate. In this instance, the survey was sent out to a targeted group of individuals to analyze their views on a particular subject matter. Fortunately, we received responses from 65%(120 responses) of the total number of respondents.

Mean and standard deviation are two essential statistical measures used to analyse survey data. The mean is the average value of a set of data, while the standard deviation is a measure of the variability or dispersion of the data around the mean. Table 3 contains the mean and standard deviation of the data collected during the survey.

The 95% confidence interval is an important statistical measure used in survey data analysis to estimate the range of values that the true population parameter is likely to fall within. It provides a degree of precision to the sample mean, identifies the range of plausible values for the population parameter, and allows for the comparison of means between different groups or categories.

95% confidence interval = Mean ±(1.96 x Standard deviation / Square root of sample size)

For this survey, the sample size is 120. The 95% confidence interval for the survey data is calculated in Table 4.

Table 1 : Survey Questions and Labels

Question	Label
Virtual tours provide a more immersive experience than traditionalphotographs and videos.	VT1
Virtual tours help potential buyers get a better sense of the property beforevisiting it in person.	VT2
Virtual tours are more convenient than physically visiting properties.	VT3
Virtual tours are a useful tool for evaluating properties when location is anobstacle.	VT4
Virtual tours make it easier to compare multiple properties.	VT5
Virtual tours increase buyer confidence in making a purchase decision.	VT6

I would be more likely to buy a property if it had a virtual tour.	VT7
I expect virtual tours to become a standard feature in real estate platforms.	VT8
The cost of producing virtual tours is a significant barrier to adoption.	VT9
The quality of virtual tours is an important factor in their usefulness.	VT10
The ease of use of virtual tours is an important factor in their usefulness.	VT11
I am comfortable using virtual tours to evaluate properties.	VT12
Virtual tours should be available for all types of properties (e.g., residential,commercial).	VT13
Virtual tours should be available on all real estate platforms.	VT14
Virtual tours are an important factor in my decision-making process whenevaluating properties.	VT15

Table 2 : Summary of the Survey Responses

Label	Responses				
	A	B	C	D	E
VT1	0	5	25	60	30
VT2	2	10	41	53	14
VT3	4	11	21	57	27
VT4	0	8	19	43	50
VT5	1	7	30	54	28
VT6	17	25	50	20	8
VT7	15	32	36	27	10
VT8	0	2	27	62	29
VT9	0	1	15	27	77
VT10	3	12	21	37	47
VT11	0	0	18	41	61
VT12	31	48	31	10	0
VT13	0	2	43	51	24
VT14	0	0	51	43	26
VT15	7	37	13	41	22

Table 3 : Mean and Standard Deviation

Label	Mean	Standard Deviation
VT1	3.96	0.79
VT2	3.56	0.86
VT3	3.77	1.01
VT4	4.13	0.91
VT5	3.84	0.88
VT6	2.81	1.08
VT7	2.88	1.14
VT8	3.98	0.73
VT9	4.50	0.74
VT10	3.94	1.09
VT11	4.36	0.73
VT12	2.17	0.91
VT13	3.81	0.77
VT14	3.79	0.77
VT15	3.28	1.24

Table 4 : 95% Confidence Interval

Label	95% Confidence interval
VT1	3.82 - 4.10
VT2	3.40 - 3.71
VT3	3.59 - 3.95
VT4	3.96 - 4.29
VT5	3.69 - 4.00
VT6	2.61 - 3.00
VT7	2.67 - 3.08
VT8	3.85 - 4.11
VT9	4.37 - 4.63
VT10	3.75 - 4.14

VT11	4.23 - 4.49
VT12	2.00 - 2.33
VT13	3.67 - 3.95
VT14	3.65 - 3.93
VT15	3.06-3.51

6. DISCUSSION

Based on the survey responses collected, it can be concluded that virtual tours are generally viewed as a useful tool for evaluating properties in the real estate industry. Respondents believed that virtual tours provide a more immersive experience (mean score of 3.96) and are useful for evaluating properties when location is an obstacle (mean score of 4.14). Respondents also found virtual tours to be convenient (mean score of 3.77) and helpful in comparing multiple properties (mean score of 3.84).

However, some barriers to adoption were identified. The cost of producing virtual tours was viewed as a significant barrier to adoption (mean score of 4.50), and respondents believed that the quality of virtual tours (mean score of 3.94) and ease of use (mean score of 4.36) were important factors in their usefulness.

Respondents were less confident in virtual tours increasing buyer confidence in making a purchase decision (mean score of 2.81) and were not necessarily more likely to buy a property if it had a virtual tour (mean score of 2.88). Additionally, respondents were not comfortable using virtual tours to evaluate properties (mean score of 2.17).

Overall, respondents believed that virtual tours should be available for all types of properties (mean score of 3.81) and on all real estate platforms (mean score of 3.79). Virtual tours were considered an important factor in the decision-making process when evaluating properties, although the mean score of 3.28 suggests that there is room for improvement in this area. Based on these responses, it can be inferred that virtual tours are generally viewed positively in the real estate industry, although there are barriers to adoption and areas for improvement.

The results of the survey suggest that virtual tours are likely to be an essential feature of real estate platforms in the future. The high level of agreement on the usefulness of virtual tours indicates that they offer a more immersive and engaging experience for potential buyers, which can increase their confidence in making a purchase decision. This finding is consistent with previous studies that have shown that virtual tours can improve customer satisfaction and reduce the time taken to make a decision.

The survey also highlights the need for real estate platforms to invest in producing high-quality virtual tours that are easy to use and accessible to potential buyers. The cost of producing virtual tours was identified as a significant barrier to adoption, and it is essential for real estate platforms to find ways to make them more cost-effective. This could involve using more affordable technologies such as 360-degree cameras or outsourcing the production to third-party providers.

7. CONCLUSION

VR technology is an exciting development in the real estate market. It has the potential to make real estate sales more efficient and effective, allowing agents to work smarter and faster. For example, using VR tours can help potential buyers make an early decision on whether a house is worth their time by showing them what this property looks like from all angles. In addition, it creates a virtual interaction between properties and buyers which can be used for marketing purposes as well as selling them something they want/need.

In conclusion, the survey results indicate that virtual tours are likely to be a critical feature of real estate platforms in the future. The high level of agreement on their usefulness suggests that they provide a more immersive and engaging experience for potential buyers, which can increase their confidence in making a purchase decision. However, the adoption of virtual tours is still limited by various factors, including the cost of production and the quality of the virtual tours. Real estate platforms need to address these barriers to ensure that virtual tours become a standard feature in the industry.

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