Virtual Dark Tourism: Exploring VR and AR Experiences of Historic Tragedies and Dangerous Locations

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Abstract— **The tourism industry has experienced significant transformation with the rapid integration of digital technologies. One of the most notable developments in this transformation is virtual tourism which is enables individuals to explore destinations through immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR) without the need for physical travel. These technologies create interactive and simulated environments that allow users to experience locations remotely while maintaining a high level of engagement and realism. Within this digital evolution the concept of virtual dark tourism has emerged as a new way to explore sites associated with historical tragedies, disasters, wars and dangerous environments. Such locations often carry important historical and cultural significance but physical visits may raise ethical, environments and safety concerns.**

This study aims to examine the awareness, perception and acceptance of virtual dark tourism among potential users. The research also evaluates whether immersive technologies can provide an ethical, educational and sustainable alternative to traditional visits to sensitive or historically tragic locations. Primary data were collected through a structured questionnaire distributed online, generating 200 responses. The collected data were analyzed using SPSS statistical tools including descriptive analysis, reliability testing and One-Way ANOVA.

The results indicate that a majority of respondents are aware of the concept of dark tourism an believe that immersive technologies can significantly enhance understanding of historical tragedies and culturally significant events. Many respondents also expressed interest in exploring such sites virtually due to factors such as accessibility, safety, reduced travel costs an emotional comfort. However, participants also raised concerns related to realism, ethical sensitivity and the accurate emotional representation of tragic events in virtual environments. The study concludes that virtual dark tourism has strong potential as an educational and responsible extension of tourism when supported by ethical storytelling and historical accuracy.

Index Terms— **Virtual Dark Tourism, Virtual Reality, Augmented Reality, Immersive Tourism, Digital Heritage.**

I. INTRODUCTION

Tourism has traditionally relied on physical travel and in-person experiences where individuals visit destinations to explore cultural, historical and natural environments firsthand. However, over the past decade technological advancement has significantly transformed the way people interact with destinations and historical narratives. Emerging technologies such as Virtual Reality (VR) and Augmented Reality (AR0 have enabled the digitization of tourism experiences allowing users to explore environments in immersive and interactive ways without being physically present. These innovations have expanded the boundaries of tourism by offering virtual access to locations that may otherwise be geographically distant. Financially inaccessible or physically restricted.

Virtual tourism in particular has gained prominence as it provides immersive simulations, interactive storytelling and digitally reconstructed environments that replicate real-world experiences. Through VR headsets, mobile applications and web-based platforms, users can engage with destinations in a highly engaging manner. Such technologies are increasingly being adopted in museums, heritage sites and educational platforms to enhance learning, improve visitor engagement and preserve cultural heritage. In addition. Virtual tourism has proven especially relevant in situations where physical travel is limited such as during global crises like the COVID-19 pandemic further accelerating its adoption and development.

One specific segment of tourism that has garnered increasing attention is dark tourism which involves locations associated with death, tragedy, disaster or historically significant events. These sites often

include war memorials, genocide museums, disaster zones, abandoned cities and other emotionally sensitive locations. Dark tourism offers opportunities for reflection, education and remembrance. However, it also raises ethical and practical concerns. The commercialization of such sites, overcrowding, environmental degradation and the potential insensitivity toward affected communities are some of the key challenges associated with physical visits.

In response to these concerns, the concept of virtual dark tourism has emerged as a viable and ethical alternative. By leveraging immersive technologies, individuals can experience and learn about sensitive historical sites without physically visiting them. Virtual dark tourism allows users to engage deeply with historical narratives, explore reconstructed environments and access curated content that promotes understanding and empathy. Moreover, it reduces the risk of damaging fragile sites and minimizes the ethical dilemmas associated with commodifying tragedy.

Furthermore, virtual dark tourism enhances accessibility by enabling individuals from diverse backgrounds including those with physical disabilities or financial constraints to experience such locations. It also allows for the integration of multimedia elements such as audio guides, archival footage and interactive storytelling which can enrich the educational value of the experience. As technology continue to evolve virtual dark tourism has the potential to redefine how societies remember and engage with difficult histories while ensuring sustainability and ethical responsibility.

II. LITERATURE REVIEW

The integration of immersive technologies into tourism has attracted increasing academic attention. Researchers have highlighted the potential of VR and AR technologies to transform tourism experiences by creating interactive and engaging environments. Guttentag (2010) explained that virtual reality technologies can simulate real-world environments and provide immersive experiences similar to physical travel. VR environments allow users to explore destinations visually and spatially. The concept of dark tourism was introduced by Lennon and Foley (2000) who described it as tourism involving visits to sites associated with tragedy, death, or disasters. These locations often serve educational and commemorative purpose. However, scholars have also raised ethical concerns about dark tourism. Physical visits to sensitive sites may lead to commercialization of tragedy, overcrowding and disrespect toward victims or affected communities. Virtual tourism provides an alternative approach by allowing digital reconstruction of historical sites. Immersive technologies enable users to explore sensitive locations without causing physical damage or ethical concerns [5], [11].

Recent studies suggest that immersive experiences can evoke emotional responses and improve learning outcomes when presenting historical narratives. However, researchers emphasize the importance of ethical storytelling and historical accuracy [12].

Research Gap:

Although previous studies have explored virtual tourism and dark tourism separately, limited research has focused on the intersection of immersive technologies and dark tourism experiences especially in the Indian context. Most research has concentrated on VR for entertainment or destination marketing. There is still a lack of empirical studies examining how virtual representations of tragic historical events influence user perception, emotional responses and ethical awareness.

This study attempts to address this gap by examining public awareness, acceptance and concerns regarding Virtual Dark Tourism experiences.

III. RESEARCH OBJECTIVES

1. To examine the concept and growth of virtual dark tourism using VR and AR technologies.
2. To analyze the role of immersive technologies in enhancing understanding of historical tragedies.
3. To assess awareness and acceptance of virtual dark tourism among potential users.
4. To identify challenges and ethical concerns associated with virtual representation of tragic events.

Hypothesis:

H1- Virtual dark tourism using VR and AR can serve as an ethical, sustainable and educational alternative to physical visits to tragic or dangerous locations.

IV. RESEARCH METHODOLOGY

Research methodology refers to the systematic process used to collect, analyze and interpret data in order to address the research objectives. For the present studies on Virtual Dark Tourism and the role of VR and AR technologies a structured methodological approach was adopted to ensure reliability and accuracy of findings. The methodology explains the research design, data sources, sampling method, population and analytical tools used in the study.

Research Design

The study adopts a descriptive and analytical research design. Descriptive research is used to understand respondent's awareness and perceptions while analytical research examines relationship between variables such as technology awareness, learning perception and recommendations behavior. Together these approaches help analyze how perceptions influence acceptance of virtual dark tourism.

Sources of Data

The study is based primarily on primary data supported by relevant secondary sources.

Primary Data

Primary data was collected directly from respondents using a structured questionary. This method allowed the researcher to gather first-had information about individual's awareness, perception ad attitudes toward virtual dark tourism experiences.

Secondary Data

Secondary data was used to provide theoretical background and contextual understanding of the research topic. Secondary sources included:

- Academic journals and research papers
- Tourism industry reports
- Online database and articles
- Books related to tourism and immersive technologies

These sources helped in developing the literature review and understanding the broader context of virtual tourism and dark tourism.

Data Collection Method-

The primary data for the study was collected using structures questionnaire.

The questionnaire was designed to gather information about

- Awareness of dark tourism
- Familiarity with VR and AR technologies
- Perception of immersive technologies as learning tools
- Interest in exploring historical tragedies through virtual platforms
- Ethical concerns related to virtual representation of tragic events
- Willingness to recommend virtual dark tourism experiences.

The questionnaire included a combination of:

- Multiple-choice questions
- Likert scale statements
- Closed-ended questions

The survey was distributed through online platforms such as Google Forms, social media and messaging applications. This method was selected because the research topic itself relates to digital technologies, making digitally active respondents the most appropriate target group. Participation in the survey was voluntary and respondents were assured that their responses would remain confidential and used only for academic purpose.

Population of the Study

The population of the study includes individuals who are potential users of immersive tourism experiences. The target population consisted mainly of college students, young professionals, digitally active individuals, individuals familiar with VR and AR technologies.

Sampling Method

The study used non-probability sampling specifically convenience sampling where respondents were selected based on accessibility and willingness to participate. The questionnaire was distributed through academic networks and social media. Some elements of purposive sampling were also included by targeting individuals familiar with digital technologies.

Sample Size

The final dataset consisted of 200 valid responses.

All collected responses were complete and no missing data was recorded. The absence of missing values indicates that respondents carefully completed the

questionnaire making the dataset reliable for statistical analysis.

Data Analysis Tools:
The collected data was analyzed using SPSS software. The following statistical techniques were used:

1. Descriptive Analysis

Descriptive statistics were used to summarize respondents' awareness, perceptions and attitudes toward virtual dark tourism. Frequency distributions, percentage and charts were used to interpret the results.

2. Reliability Analysis

Cronbach's Alpha was used to evaluate the internal consistency of selected variables in the questionnaire.

3. ANOVA Test:

A One-Way ANOVA test was conducted to examine difference in recommendation behavior among respondents with varying levels of familiarity with VR technologies. These statistical methods helped in identifying patterns in the data and evaluating the research hypothesis.

Ethical Considerations
Ethical considerations were carefully maintained during the research process. Participation in the survey was voluntary and respondents were informed that their responses would remain anonymous and confidential. The questionnaire avoided sensitive or disturbing content related to tragic historical events in order to ensure emotional comfort for participants. All collected data was used solely for academic research purpose.

V. RESULTS AND DISCUSSION-

The data collected from the survey was analyzed using SPSS (Statistical Package for Social Sciences). A total of 200 valid responses were included in the analysis. The purpose of this analysis was to understand respondents' awareness of dark tourism, their familiarity with immersive technologies such as VR and AR and their perceptions regarding the use of these technologies for experiencing historical tragedies. The analysis included descriptive statistics, reliability testing and ANOVA analysis to examine patterns in respondents' attitudes and evaluate the research hypothesis.

1. Descriptive Analysis-

Descriptive statistics were used to summarize questionnaire responses and identify overall trends. The analysis focused on awareness of dark tourism, familiarity with VR/AR, perception of immersive technologies, interest in virtual exploration and related motivations and concerns. The dataset included 200 valid responses with no missing values.

	Awareness Dark Tourism	Virtual Reality Awareness Level	Virtual Reality Learning	Virtual Reality Interest	Virtual Reality Motivation	Virtual Dark Tourism Concerns	Virtual Reality Ethical Respect	Virtual Dark Tourism Main Goal	Virtual Dark Tourism Recommend	
N	Valid	200	200	200	200	200	200	200	200	200
	Missing	0	0	0	0	0	0	0	0	0

Table 1

- Awareness of Dark Tourism-

	Frequency	Percent	Cumulative Percent	
Valid	0	50	25.0	25.0
	1	150	75.0	100.0
	Total	200	100.0	

Table 1.1

Interpretation-

- As shown in Table 1.1 75% of respondents are aware of dark tourism while 25% are not showing growing recognition among digitally active individuals.
- The relatively high awareness may be influenced by exposure to documentaries, online travel content and academic discussions related to historical and heritage tourism.
- However, the lack of awareness among some respondents suggests the need for greater public awareness and academic discussion.

- Familiarity with VR and AR Technologies-

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	23	11.5	11.5	11.5
	2	64	32.0	32.0	43.5
	3	73	36.5	36.5	80.0
	4	40	20.0	20.0	100.0
	Total	200	100.0	100.0	

Table 1.2

Interpretation-

- As shown in Table 1.2, most respondents are somewhat familiar with VR and AR (36.5%) while 20% report high familiarity and 32% have only heard of them, indicating growing awareness with limited practical exposure.
- This suggests that immersive technologies are becoming increasingly popular but have not yet reached widespread usage.

- Perception of VR and AR as Educational Tools-

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	18	9.0	9.0	9.0
	3	43	21.5	21.5	30.5
	4	64	32.0	32.0	62.5
	5	75	37.5	37.5	100.0
	Total	200	100.0	100.0	

Table 1.3

Interpretation-

- As shown in Table 1.3, a majority of respondents around 70% agree that VR and AR technologies enhance learning about historical tragedies indicating a strong positive perception.
- This suggests that immersive technologies can create interactive and engaging environments that improve understanding of historical events.

Interest in Virtual Exploration-

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	35	17.5	17.5	17.5
	2	46	23.0	23.0	40.5
	3	119	59.5	59.5	100.0
	Total	200	100.0	100.0	

Table 1.4

Interpretation-

- As shown in Table 1.4, 59.5% of respondents are interested in virtual exploration of tragic sites while 23% are uncertain and 17.5% are not interested.
- This indicates strong potential for virtual dark tourism due to its accessibility, safety and convenience.
- Respondents who selected 'Maybe' may require better realism, storytelling or familiarity with immersive technologies.

Motivational Factors for Virtual Dark Tourism

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	31	15.5	15.5	15.5
	2	36	18.0	18.0	33.5
	3	61	30.5	30.5	64.0
	4	20	10.0	10.0	74.0
	5	52	26.0	26.0	100.0
	Total	200	100.0	100.0	

Table 1.5

Interpretation-

- As shown in Table 1.5, curiosity and emotional engagement are the key motivations for virtual dark tourism while entertainment is the least significant.
- This indicates that users approach virtual dark tourism with a thoughtful and reflective mindset.
- It also suggests that virtual dark tourism servers more as an educational and awareness building experiences rather than entertainment.

Concerns Related to Virtual Dark Tourism

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	50	25.0	25.0	25.0
	2	47	23.5	23.5	48.5
	3	71	35.5	35.5	84.0
	4	32	16.0	16.0	100.0
	Total	200	100.0	100.0	

Table 1.6

Interpretation-

- As shown in Figure 1.6, the most common concern among respondents is lack of realism 35.5% highlighting the importance of authenticity in virtual experiences.
- Ethical concerns and emotional discomfort are also significant indicating the need for responsible representation of tragic events.
- Technical issues are less prominent suggesting that emotional and ethical factors are greater barriers than technological limitations.

Ethical Perception of Virtual Dark Tourism-

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	31	15.5	15.5	15.5
	2	52	26.0	26.0	41.5
	3	117	58.5	58.5	100.0
	Total	200	100.0	100.0	

Table 1.7

Interpretation-

- As shown in Table 7, 58.5% of respondents believe virtual dark tourism can be presented respectfully while 26% remain uncertain.
- This reflects cautious optimism among users toward immersive technologies.
- However, the neutral responses suggest that acceptance depends on ethical design and accurate storytelling.

Reliability Analysis

To evaluate the consistency of selected variables, Cronbach's Alpha reliability test was conducted.

Reliability Statistics	
Cronbach's Alpha	N of Items
.243	2

Table 2

To evaluate the consistency of selected variables, Cronbach's Alpha reliability test was conducted.

Interpretation-

- As shown in Table 2, the Cronbach's Alpha value is 0.243 indicating relatively low internal consistency.
- This is due to the inclusion of only two variables measuring different constructs.
- Therefore, the result suggests that virtual dark tourism is evaluated across multiple dimensions rather than a single construct.

ANOVA Analysis

A One-Way ANOVA test was conducted to examine whether familiarity with VR technologies influences respondent's likelihood of recommending virtual dark tourism experiences.

	N	Mean	Std. Deviation
1	23	3.74	1.322
2	64	4.00	1.054
3	73	4.34	.820
4	40	3.88	1.159

Table 3

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9.772	3	3.257	3.051	.030
Within Groups	209.248	196	1.068		
Total	219.020	199			

Table 3.1

Test of Homogeneity of Variances			
Levene Statistic	df1	df2	Sig.
2.709	3	196	.046

Table 3.3

Interpretation-

- The overall mean recommendation score was 4.07 indicating a strong positive intention among respondents to recommend virtual dark tourism experiences.

Levene's Test

Levene Statistics = 2.709

Significance value = 0.046

- The significance value slightly below 0.05 indicates minor difference in variance among respondents' groups. This suggests that familiarity with immersive technologies may influence recommendation behavior.
- Overall, the ANOVA results support the research hypothesis that immersive technologies positively influence acceptance of virtual dark tourism experiences

Hypothesis Testing

Hypothesis-

Virtual dark tourism using VR and AR can serve as an ethical and educational alternative to physical visits to tragic or dangerous locations.

Based on the statistical findings-

- Majority respondents believe VR improves learning.
- Many respondents expressed interest in virtual exploration.
- Recommendation intention scores were high

Therefore, the results support the proposed hypothesis

Discussion-

The purpose of the study was to examine public awareness, perception an acceptance of virtual dark

tourism experiences supported by immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR). The findings provide important insights into how individuals perceive the role of immersive technologies in exploring historically sensitive locations.

One of the key findings is the relatively high awareness of dark tourism among respondents. The descriptive analysis showed that a large proportion of participants were familiar with the concept of dark tourism. This suggests that discussions about historically significant sites associated with tragedy or disaster are becoming more visible in media, educational platforms tourism discourse. Growing interest in historical storytelling and heritage preservation may also contribute to increased awareness among younger and digitally active audiences.

The result also indicates moderate to high familiarity with VR and AR technologies among respondents. While many participants were aware of immersive technologies are gradually becoming part of mainstream digital culture through applications in gaming, education and entertainment. However, the gap between awareness and practical usage indicates that wider adoption may depend on improved accessibility and affordability of these technologies.

Another important finding is the strong perception of VR and AR as educational tools. A majority of respondents agreed that immersive technologies can enhance learning about historical tragedies. Virtual environments can recreate spatial settings and narratives that help users visualize events and develop a deeper understanding of historical contexts.

The results also reveal a significant level of interest in exploring historically sensitive locations through virtual platforms. Many respondents expressed willingness to experience such sites virtually rather than physically visiting them. Virtual experiences offer practical advantages such as accessibility, reduced travel costs and the ability to explore locations that may be dangerous or geographically inaccessible. However, the study also identified concerns relate to realism and ethical representation. Participants indicated that the environments narratives are recreated. Ethical concerns were also raised regarding the possibility that virtual representations might unintentionally trivialize human suffering if not presented responsibly.

Overall, the findings suggest that virtual dark tourism has strong potential as an educational and ethical extension of traditional tourism. However, the development of such experiences must emphasize historical accuracy, ethical storytelling and responsible design to ensure respectful representation of sensitive historical events.

VI. CONCLUSION

This study explored the emerging concept of virtual dark tourism and examined how immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR) influence the way individuals' experiences historically sensitive locations. The research focused on understanding public awareness, perception, motivations and ethical concerns related to virtual representations of tragic historical events.

The findings indicate that awareness of dark tourism is relatively high among digitally active individuals. A majority of respondents were familiar with the concept and showed interest in learning about historical tragedies and culturally significant events. This suggests that people are increasingly seeking meaningful and knowledge-based tourism experiences rather than purely recreational travel.

The study also revealed that respondents are moderately familiar with immersive technologies such as VR and AR. Although many participants have heard about these technologies, fewer have direct experiences using them. Despite this, respondents demonstrated a positive attitude toward the use of immersive technologies as tools for learning and exploration. Many participants agreed that VR and AR can enhance understanding of historical events by creating engaging and interactive environments.

Another key finding is the strong interest in exploring historically sensitive locations through virtual platforms. Virtual dark tourism offers advantages such as improved accessibility, enhanced safety and reduced environmental impact on fragile heritage sites. Through digital simulations, users can experience historical narratives while avoiding many of the logistical and ethical challenges associated with physical visits.

However, the study also highlights concerns regarding realism, emotional sensitivity and ethical representation of tragic events. These findings

emphasize the importance of responsible design and accurate storytelling in developing virtual dark tourism experiences.

Overall, the results suggest that virtual dark tourism has strong potential as an ethical, educational and sustainable complement to traditional tourism. As immersive technologies continue to evolve, they are likely to play an increasingly important role in shaping how individuals engage with historical memory and global heritage.

Author Contributions Statement-

Name of Author	C	M	SO	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Sanchita Bongale	☑	☑			☑	☑		☑	☑	☑	☑			
Harsh Rathi	☑	☑			☑	☑		☑	☑	☑	☑			
Dr. Younis Mohammad Malik	☑	☑		☑	☑		☑			☑		☑	☑	

C	Conceptualization
M	Methodology
So	Software
Va	Validation
Fo	Formal Analysis
I	Investigation
R	Resources
D	Data Curation
O	Writing- Original Draft
E	Writing- Review & Editing
Vi	Visualization
Su	Supervision
P	Project Administration
Fu	Funding Acquisition

Conflict of Interest Statement-

The authors declare that there are no financial, personal or professional conflicts of interest that could have influenced the research or the publication of this study.

Information Consent-

Informe consent was obtained from all participants involved in the survey. Participants were informed about the purpose of the research and were assured that their responses would remain anonymous and confidential. Participation in the survey was voluntary.

VII. ETHICAL APPROVAL

The research involving human participations was conducted in accordance with accepted academic and ethical research standards. All responses were collected anonymously and use strictly for academic research purposes.

VIII. DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The dataset includes survey responses collected for academic research purposes and is not publicly available to maintain participants confidentiality.

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