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TouriaVR:
"Connecting Worlds Through Interactive Tourism"

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

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ABSTRACT

TouriaVR is an innovative virtual reality (VR) tourism application that addresses the limitations of traditional travel by offering immersive and accessible experiences. This project leverages VR technology, with a strong foundation in Unreal Engine, to provide users with the opportunity to explore diverse destinations, all from the comfort of their VR headsets. By capturing high-quality 360-degree content and offering interactive features, TouriaVR empowers users to embark on virtual journeys enriched with historical and cultural insights. This paper outlines the project's objectives, methodologies, design details, cost analysis, testing, and relevant literature. Drawing insights from recent research, TouriaVR aims to revolutionize the tourism industry, offering a cost-effective and engaging solution for users seeking to overcome barriers to travel, such as financial limitations, security concerns, health restrictions, and bureaucratic complexities. TouriaVR's use of Unreal Engine 5 serves as the technological backbone, enabling the delivery of photorealistic graphics and interactive content, further enhancing the user's virtual tourism experience.

1. INTRODUCTION

1.1 Problem Statement

The specific problem that TouriaVR aims to address is the limited accessibility to travel due to various barriers. These barriers can include:

- Financial limitations: The cost of travel can be a significant barrier for many people, especially those on low incomes.
- Security concerns: Some people may be hesitant to travel to certain destinations due to concerns about their personal safety.
- Health restrictions: People with certain health conditions may be unable to travel due to the physical demands involved or the risk of exposure to illness.
- Bureaucratic complexities: The visa application process and other bureaucratic requirements can be complex and time-consuming, especially for international travel.

Such issues can significantly influence a person's decision not to embark on a physical journey, leading to missed opportunities for cultural exploration and learning.

1.2 Objectives

1.2.1 General Objective

The general objective of the TouriaVR project is to use the principles and methodologies learned from our computer engineering courses (CPEN 425/455/452/358) to create an innovative solution for accessible and engaging virtual tourism.

1.2.2 Specific Objectives

The specific objectives that contribute to the general objective include:

- Developing a Virtual Reality (VR) application that utilizes VR headsets and controllers for immersive user experiences.
- Capturing high-quality 360-degree content.
- Offering users full autonomy over their view, allowing them to interact with and explore their surroundings using VR controllers.
- Implementing a voice-over guide that enriches the user's experience with historical and cultural insights.
- Ensuring language selection options in the main menu for users' convenience.
- Prioritizing security standards and user data protection to safeguard privacy.
- Designing a user-friendly and intuitive interface for seamless user experiences.
- Creating a scalable system capable of accommodating future expansion, including the addition of new tours and destinations.
- Ensuring system reliability with minimal downtime and the ability to recover gracefully from errors.

1.1 Constraints

The TouriaVR project is subject to certain constraints, including but not limited to:

- Technical limitations associated with VR hardware and software development.
- Budgetary constraints that may affect the project's scope and scale.
- Adherence to industry standards and regulations governing VR technology.
- Ensuring the security and privacy of user data.
- Meeting user expectations for high-quality and immersive experiences.
- Potential limitations in available resources and time constraints.

2. LITERATURE REVIEW

Virtual reality is a technology that immerses users in computer-generated environments, offering a comprehensive sensory experience, often through the use of a VR headset and accompanying devices. The historical development of VR has evolved from early experiments to modern consumer devices. VR has found applications in a wide range of fields, including gaming,

education, healthcare, architecture, and training. Researchers have also explored the psychological effects of VR on users, addressing issues like simulator sickness, presence, and its impact on emotions and memory. Ongoing advancements in VR hardware and software have led to improved user experiences, and VR cameras are instrumental in capturing immersive content with techniques for 360-degree video production and 3D modeling.

The field of VR includes a focus on creating interactive narratives and storytelling within these immersive environments. Ethical concerns related to privacy and addiction are emerging as critical areas of discussion. As VR continues to evolve, challenges such as hardware limitations are at the forefront, and comparisons with augmented reality contribute to a broader understanding of extended reality technologies. This dynamic and multifaceted area of study continues to shape the way we experience and capture virtual environments. However, the regulations for virtual reality must be followed which focus on ensuring user safety, data privacy, and content appropriateness, with considerations for motion sickness and content regulations. The technical standards are established to ensure the quality and compatibility of VR hardware and software, while accessibility standards aim to make VR experiences inclusive for people with disabilities. Operational experience in VR spans training and simulations, therapeutic applications, entertainment, and gaming, with constant user feedback and iteration driving improvement. Furthermore, VR's dynamic nature and its ethical implications mean that ongoing adaptation and vigilance in areas like data privacy, addiction, and societal impact are crucial for the responsible development and use of VR technologies.[3]

In order to provide equal access and opportunity for people with disabilities, it is critical to address the issues that come up as virtual reality continues to develop. This entails taking into account things like making user interfaces accessible to those with vision impairments or coming up with alternate input techniques for people with limited mobility. Furthermore, in order to lessen the possibility of VR having a detrimental impact on social and mental health, research and development must be given top priority.

3. METHODOLOGY

3.1 XP (Extreme Programming)

Extreme Programming (XP) is an agile software development methodology that prioritizes short iterations and frequent code releases to enhance productivity and accommodate evolving requirements.[8] Key practices in XP include:

- Planning Game: Fosters close collaboration between customers and developers for requirement estimation and prioritization.
- Small Releases: Emphasizes early system releases for operation, with additional features delivered in subsequent releases.

- Metaphor: Encourages the development team and customers to create metaphors to model the system, ensuring shared understanding.
- Simple Design: Promotes straightforward system design.
- Test-First Principle: Developers write acceptance tests before the code, while customers create functional tests for each iteration.
- Refactoring: Involves improving the system's design to ensure successful test cases.
- Pair Programming: Collaborative code writing with continuous integration to validate tests.
- Collective Ownership: All developers share ownership of the code.
- On-Site Customer: Customer involvement in the development process.
- Work Hours: Promotes a standard 40-hour workweek to avoid overtime.
- Open Workspace: Shared work environment with pair programmers using a common development machine.
- Adherence to Just Rules: The team follows a set of flexible rules, adjusted by consensus.

These practices enable XP to deliver software in an agile, adaptive, and collaborative manner .[8]

3.2 Project Overview and Application of XP

In the context of our project, TouriaVR, which focuses on creating an innovative virtual tourism application, we plan to utilize the agile methodology of Extreme Programming (XP) to enhance our development process. XP's emphasis on short iterations, continuous customer interaction, and frequent code releases aligns well with our project's objectives.

Given that our project is managed by a small team consisting of two members, XP's practices, such as pair programming and an open workspace, are particularly advantageous. These practices ensure that both team members collaborate closely, review each other's code, and maintain a shared understanding of the project's goals.

XP's principle of small releases and test-first development aligns with our project's approach to regularly delivering high-quality 360-degree video content and maintaining its interactive features. This enables us to continuously refine our product and respond to any emerging user requirements swiftly.

Furthermore, the on-site customer practice will play a pivotal role in our project. Having a customer involved throughout the development process helps ensure that we remain aligned with user expectations and receive real-time feedback, which is crucial for delivering a product that meets the needs of our target audience.

By adopting XP in our project methodology, we aim to create a dynamic and collaborative development environment that not only enhances productivity but also allows us to promptly adapt to evolving project requirements and user feedback. This approach is fundamental to our goal of delivering an immersive virtual tourism experience through TouriaVR.

3.3 Requirements

3.3.1 Functional Requirements

- Startup Sequence:
  - Ensure the application initiates by displaying an engaging logo to attract users.
- Main Menu:
  - After the startup sequence, present a user-friendly main menu with options for navigation and tour selection.
- Tour Selection:
  - Allow users to select from a variety of available tours, each representing different destinations.
- Path Selection:
  - Enable users to choose specific paths or routes within a tour, providing a more customized and immersive experience.
- Voice-Over Guide:
  - Implement a voice-over guide during tours, providing historical and cultural information to enhance the user experience.
- Spectating:
  - Enable users to pause the tour and spectate their surroundings to explore freely within the environment.
- Tour Restart and Selection:
  - At the end of a tour, allow users to choose another tour, replay the current one, or return to the main menu for further exploration.
- Content Creation:
  - Utilize 360-degree cameras to capture high-quality content for diverse destinations, ensuring content is clear, detailed, and accurately represents chosen locations.
- Interactivity:
  - Provide users with the ability to interact with the virtual environment using VR controllers, including precise hand tracking, gesture recognition, and haptic feedback, to enhance the immersive experience.
- Subtitle Inclusion:
  - Enable users to access subtitles in Spanish and English for an inclusive experience.
- Language Selection:
  - Implement language selection options in the main menu for user convenience.
- Mute Experience:
  - Allow users to mute the audio experience, providing the option to enjoy the VR tour without voice-over guidance or other audio elements. This feature enhances user control and customization of the experience.

3.3.2 Non-functional Requirements

- Performance:
    - The system should efficiently load tour content to minimize user wait times and ensure that VR experiences are rendered smoothly for an enjoyable and responsive user experience.
- Compatibility:
    - The VR application should be compatible with a wide range of popular VR headsets and controllers, ensuring that it works seamlessly with different hardware models. It should provide high-quality displays and user comfort to enhance the overall experience.
- Content Quality:
    - The 360-degree video content should meet high-quality standards, including clear, detailed, and accurate representation of the chosen destinations. The content should be visually engaging, maintaining a high level of realism to immerse users in the virtual world.
- Security:
    - The application should adhere to industry security standards to protect user data and ensure privacy. This includes secure data handling, encryption of sensitive information, and protection against potential security breaches.
- Usability:
    - The user interface should be user-friendly, intuitive, and accessible, providing an immersive experience for users. The design should cater to a wide range of users, including those who may not be familiar with VR technology, ensuring that they can easily navigate and enjoy the application.
- Scalability:
    - The system should be designed to scale and accommodate future expansion. This includes the ability to add new tours and destinations, ensuring that the application can grow with evolving user needs and preferences.
- Reliability:
    - The system should be robust and reliable, with minimal downtime. In case of errors or issues, the application should have built-in mechanisms to recover gracefully and ensure a smooth user experience, minimizing disruptions and frustration for users.

4. DESIGN DETAILS

4.1 Platform and Tools

- Development Platform:

    - TouriaVR harnesses the potential of Unreal Engine 5, a product of Epic Games, to create captivating virtual environments for tourism. Unreal Engine 5 excels in seamlessly integrating 360-degree video content, enabling precise user interaction,

managing audio and subtitles, overseeing menu systems, and efficiently storing essential data. Its powerful Blueprint Visual Scripting system facilitates object-oriented class and object creation, a cornerstone in asset development.[13]

- Unreal Engine 5's comprehensive suite of tools, including specialized editors for level design, asset management, and cinematic creation, enhances the development process. The engine's sophisticated audio capabilities, vital for crafting immersive environments, ensure sound is a pivotal element of the virtual tourism experience. Furthermore, Unreal Engine 5's real-time rendering capabilities are invaluable for applications such as virtual production and live events, allowing for stunning visual effects. In summary, Unreal Engine 5 empowers TouriaVR to provide users with an unforgettable and immersive journey through virtual tourism destinations.[13]

- VR Hardware:

Figure 1: Meta Quest 2 [12]

- TouriaVR relies on the Oculus Quest 2, developed by Oculus (a subsidiary of Meta Platforms, Inc.), for its virtual reality headset, the cornerstone of the user's interaction with the TouriaVR experience. The Oculus Quest 2 is known for its affordability and high-quality VR experiences, making it a crucial component for TouriaVR. It features high-resolution displays, powerful processing, and inside-out tracking, eliminating the need for external sensors. However, it's worth noting that prolonged use of the Quest 2 can lead to motion sickness in some users.[12]

- The Quest 2 incorporates dynamic resolution scaling, enhancing pixel density for smoother gameplay and improved immersion, essential for creating an immersive virtual tourism experience. It offers Six Degrees of Freedom (6DOF) to accurately track head and body movements, ensuring a lifelike virtual experience. The absence

of external sensors simplifies setup and use, providing a user-friendly experience. Redesigned Touch Controllers offer improved ergonomics and a thumb rest for enhanced user interactions. The Oculus Quest 2 combines affordability with impressive specifications, making it an accessible and versatile equipment for the TouriaVR project.[12]

- VR Cameras:

Figure 2: 360Fly 1st gen[11]

Figure 3: Insta360 One X2[10]

  - TouriaVR relies on VR cameras to capture immersive 360-degree content. Initially, we explored various options for panoramic content creation, with a range of cameras available in the market, each offering different levels of quality and resolution. One of the cameras we considered for the project was the 360fly. It

features a single 8-element glass ultra-fisheye lens, providing a wide 240° field of view with an aperture of f/2.5. The camera captures video at a resolution of 1504 x 1504 at 29.97 frames per second (fps), with a maximum recording rate of up to 20 Mbps VBR. Audio is recorded in mono AAC format at 48 kHz and 64 kbps. Powered by a lithium-ion polymer battery with a capacity of 1630 mAh, the 360fly offers over 2 hours of recording time.[11]

- However, a significant update to our project involves the integration of the Insta360 ONE X2 360 Degree Waterproof Action Camera. This camera stands out due to its impressive specifications, boasting a wide 5.7K resolution at 30fps, 25fps, and 24fps in 360-degree mode. Furthermore, it offers versatile shooting modes and settings for both photos and videos, including HDR, Burst, Interval, Night Shot, PureShot, InstaPano for photos, and Standard, HDR, Timelapse, TimeShift, Bullet Time, Steady Cam for videos. It also provides extensive exposure modes for both photos and videos, allowing for manual control over settings like shutter speed and ISO. The Insta360 ONE X2's advanced features and high-quality output make it a valuable addition to our VR content creation toolkit, ensuring that TouriaVR delivers immersive and engaging virtual tourism experiences. The decision to upgrade to the Insta360 ONE X2 was driven by its capacity to produce superior VR content and enhance the overall user experience within our virtual tourism application.[10]

- When comparing the 360fly to the Insta360 ONE X2, several distinctions become evident. The 360fly offers a 240° field of view and records video at 1504 x 1504 resolution, whereas the Insta360 ONE X2 boasts a significantly wider 360° field of view and captures video at a much higher 5.7K resolution. This remarkable difference in resolution results in sharper and more detailed VR content. Additionally, the Insta360 ONE X2 provides a broader range of shooting modes and extensive manual controls, enhancing the creative capabilities of our content creation. These improvements make the Insta360 ONE X2 an ideal choice for ensuring that TouriaVR's users enjoy a truly immersive and high-quality virtual tourism experience.

4.2 Structural Representation

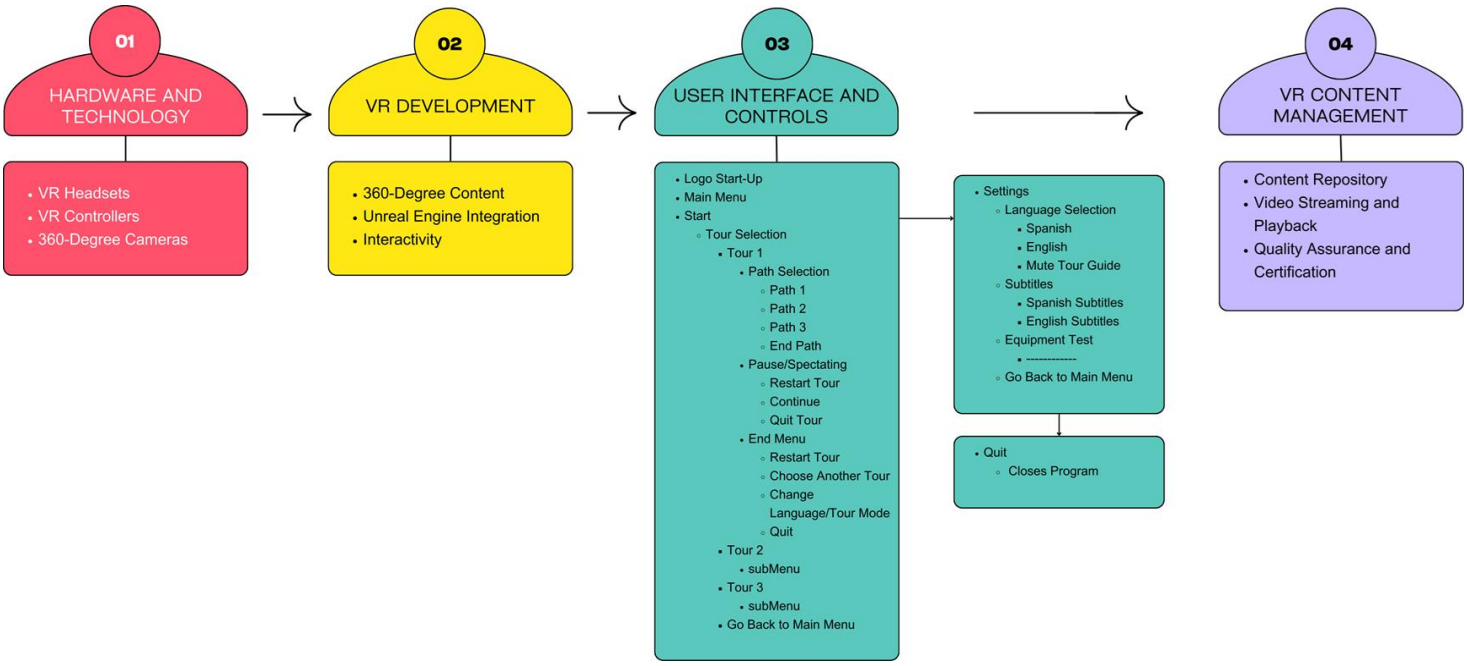

Figure 4: Structural Diagram

TouriaVR's structural diagram outlines its essential components, reflecting a comprehensive framework for creating an immersive and engaging virtual tourism experience. Within the Hardware and Technology category, VR headsets stand as the primary user interface, offering a lifelike and immersive environment for users to explore virtual destinations. VR controllers provide precision in user interactions, enhancing the immersion. The presence of 360-degree cameras is pivotal for capturing high-quality content, instrumental in creating captivating visual experiences in the virtual tours.

Under the VR Development section, the integration of 360-degree content and utilization of Unreal Engine underscore TouriaVR's commitment to creating realistic and interactive virtual environments. These components are foundational in delivering a seamless user experience.

User Interface and Controls encompass various elements tailored to enhancing user engagement and control. The logo start-up offers an engaging introduction to the application. The main menu serves as the central hub, providing a user-friendly interface with options for navigation and tour selection. Users can choose from a variety of tours, each representing distinct destinations. The inclusion of tour paths (Path Selection) allows for a more personalized and immersive

experience. Users can also benefit from the Spectating feature, which permits them to pause the tour and appreciate the view without active exploration. At the end of a tour, users have the flexibility to choose another tour, replay the current one, or return to the main menu for further exploration. The settings menu caters to customization, allowing users to select their preferred language and mute the tour guide. Language selection ensures that users can enjoy the tour in their chosen language, while subtitles provide additional accessibility. An equipment test feature may enable users to ensure the proper functioning of their VR equipment.

The VR Content Management section revolves around efficiently storing and managing 360-degree content in the content repository. Video streaming and playback components ensure that the content is delivered smoothly for an enjoyable user experience. Quality assurance and certification processes maintain high-quality standards, verifying content clarity, detail, and accuracy.

In totality, these structural components of TouriaVR cohesively work together to create an immersive and engaging virtual tourism application, offering users an exceptional opportunity to explore the world's diverse destinations from the comfort of their VR headsets.

4.3 User Relation

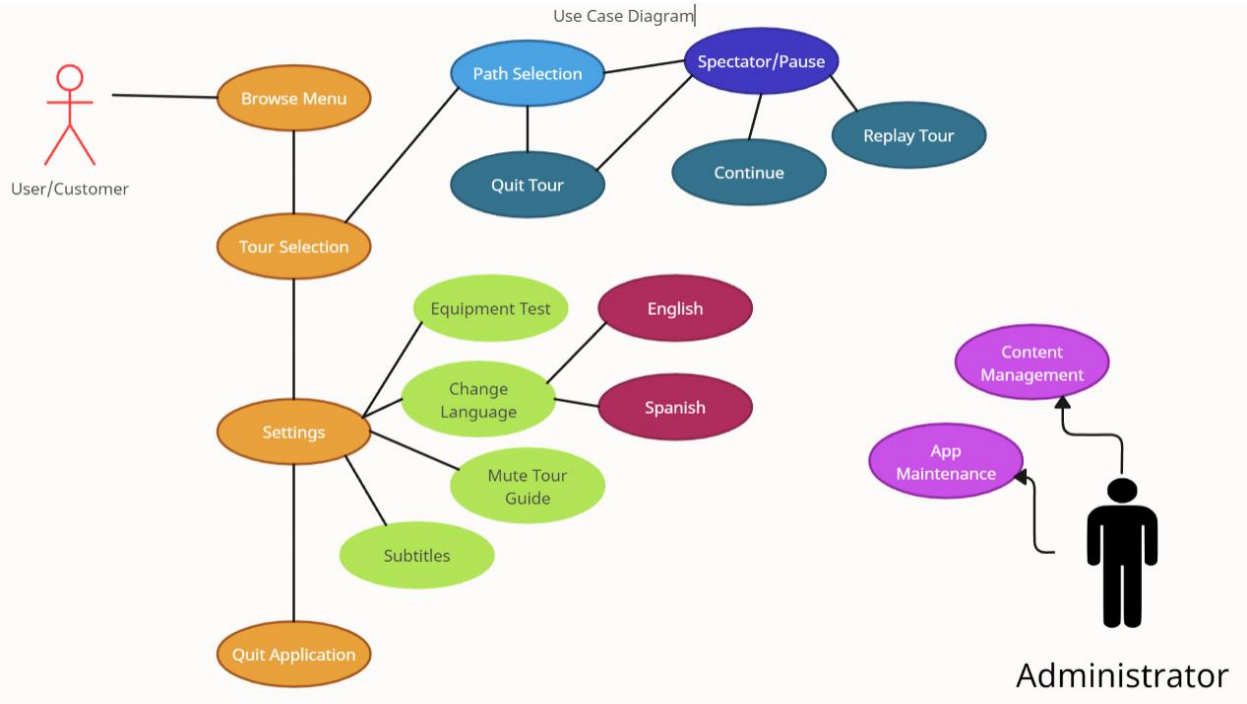

Figure 5: Use Case Diagram

- User/Customer:
    - The primary role in the use case diagram is the User/Customer, who interacts with TouriaVR through VR headsets and VR controllers. The user's journey begins with the Logo Start-Up, which provides an engaging introduction to the application. Following this, the Main Menu serves as the central navigation hub, offering a user-friendly interface with numerous options for exploration and customization. The user can initiate a tour by selecting Start, leading them to the Tour Selection process, where they choose from a variety of available tours, each representing different destinations.
    - For a more customized experience, the user has the option to engage in Path Selection, enabling them to select specific routes within the tour. During the tour, the user has control over various actions, including Pause/Spectating, which allows them to pause the tour and enjoy the view without active exploration. If they wish to alter their journey, options such as Restart Tour, Continue, and Quit Tour are available.

    - Upon completing a tour, the user can decide to select another tour, replay the current one, or return to the Main Menu for further exploration. The Settings menu offers customization features, including Language Selection (with options for Spanish and English), the ability to Mute Tour Guide, and access to Subtitles in Spanish and English for an inclusive experience. Additionally, an Equipment Test option is available to ensure the proper functioning of the VR equipment. The journey concludes with the Quit option, allowing the user to close the program.

- Administrator:
    - In the role of the Administrator, responsibilities encompass Content Management, Quality Control, and App Maintenance. The Administrator's role is integral to the content pipeline. Content Management involves overseeing the content repository, ensuring 360-degree content is appropriately stored and managed for tours. Quality Control ensures that the content meets high-quality standards, including clarity, detail, and accuracy, guaranteeing an immersive user experience. App Maintenance involves monitoring and ensuring the overall reliability and functionality of the TouriaVR application.

These roles and interactions within the Use Case Diagram define how both Users and Administrators contribute to the functionality and user experience of TouriaVR.

5. COST ANALYSIS

Product	Description	Cost
Insta360 ONE X2	Records environment in a 360 degree view.	$322.49
Oculus/Meta Quest 2	Platform for viewing and testing recordings.	$299.99
Tripod Dolly	Ease of movement for the tripod.	$30.00-$100.00
Tripod	Holds the camera in place for easy captures.	$20.00- $50.00
Protective Case	Safeguarding Camera during transport.	$10.00- $25.00

Table 1: Cost analysis

The table provided above furnishes a comprehensive financial breakdown essential to the TouriaVR project, outlining the key components needed for creating and assessing our VR content. These components encompass:

- VR Headset and Controller:
  - The Oculus/Meta Quest 2, priced at $299.99, serves as the cornerstone of our project, facilitating comprehensive testing and user immersion within our virtual tourism application.
- VR Camera:
  - The creation of immersive VR content necessitates a capable camera proficient in recording 360-degree panoramas. VR cameras, which can cost anywhere from $150.00 to $450.00, are instrumental in capturing the destinations in their full glory. Originally, the project utilized the 360fly camera, which comes in at under $100.00. However, an important project update introduces the Insta360 ONE X2, a high-quality camera priced at $322.49, to elevate the quality of our content.
- Tripod Dolly and Tripod:
  - These components are pivotal for camera stabilization, ensuring seamless movements during content creation. The tripod dolly, typically ranging from $30.00 to $100.00, and the tripod, priced at $20.00 to $50.00, collaborate to maintain the production of high-quality footage.
- Protective Case:
  - To safeguard our valuable camera, we're incorporating a protective case. Protective cases for cameras generally cost between $10.00 and $25.00.

In total, the initial investment for the TouriaVR project spans approximately from $459.99 to $524.99 when using the 360fly camera. However, incorporating the higher-quality Insta360 ONE X2 camera expands the range to approximately $691.49 to $816.49. The TouriaVR team places significant emphasis on prudent cost management, recognizing its pivotal role in the project's success. Our commitment is to strike an optimal balance between crafting captivating VR content and judicious budget allocation, positioning TouriaVR as an economical and competitive solution within the VR tourism landscape. We are dedicated to maximizing the value of every dollar spent to ensure the overall quality and triumph of the TouriaVR experience.

6. TESTING

6.1 VR Footage

Figure 6: 360Fly footage

The initial testing phase involved capturing VR footage with the 360Fly camera, which provided us with insights into the camera's functionality and its limitations. Analyzing this footage allowed us to gain an understanding of how the camera's angles work and its movement patterns, which, in turn, helped us determine the necessary tools for recording high-quality 360-degree videos with minimal blurriness and steady motion. During this process, we also assessed the video quality, noting that higher-quality videos require fewer frames per second to maintain smooth viewing. Striking a balance between video quality and smoothness is a crucial consideration.

However, the 360Fly camera had some inherent limitations, particularly in terms of video quality, and its 240-degree field of view occasionally resulted in capturing part of the camera itself in the footage. This limitation posed challenges during content creation for our project. To address this issue, we made the decision to invest in the Insta360 One X2 camera, which is currently in

transit. Testing the content created with this new camera will play a pivotal role in determining the project's trajectory, including the selection of tour destinations and path choices. Our ultimate goal is to offer users a unique and unparalleled virtual tourism experience.

7. STATE OF THE ART

As TouriaVR strives to redefine the landscape of virtual reality (VR) tourism, a comprehensive exploration of recent research studies brings forth invaluable insights that not only resonate with the project's core objectives but also lay the foundation for its strategic development and marketing.

- Research 1:
    - The research titled "Does VR Tourism Enhance Users' Experience?" explores the potential of VR (virtual reality) tourism, particularly relevant in the context of COVID-19's impact on traditional tourism. The study identifies factors influencing utilitarian and hedonic values in VR tourism experiences and their effects on users' intentions to visit real tourist destinations. Key findings emphasize the growth potential of VR tourism, highlighting benefits such as enhanced accessibility, entertainment, and improved tourism experiences. It critiques traditional models like the Technology Acceptance Model (TAM) for their limited applicability to VR experiences, underscoring the need for comprehensive models to evaluate VR tourism. The study's practical implications suggest focusing on creating immersive flow experiences and enhancing attributes like information access and interactivity. For your project, TouriaVR, this research offers valuable insights into the potential of VR in revolutionizing tourism experiences and user intentions, providing a strong basis for your VR tourism application.[7]

- Research 2:
    - The paper titled "Research progress on virtual reality (VR) and augmented reality (AR) in tourism and hospitality" offers valuable insights into the development and applications of VR and AR in the context of tourism and hospitality, which directly aligns with our project, TouriaVR. The paper reviews research published from 2000 to 2018, providing insights into the distribution of articles, cultural contexts of research, and research settings, including tourism destinations, cultural heritage sites, and more. It also presents a theoretical framework for understanding user behavior and experiences in VR and AR. Moreover, the study emphasizes the positive outcomes of implementing VR and AR technologies in the tourism industry, encouraging industry practitioners to consider adopting these technologies for strategic purposes. The paper's suggestions for future research directions, such as cross-cultural studies and applications in hospitality settings.[6]

- Research 3
    - The research article titled 'The Real Effectiveness of VR: The Tourism and Cultural Organization Managers' Point of View' by Julia Wirth and Nina Racine explores the integration of virtual reality (VR) from the perspective of tourism and cultural organization managers in Switzerland. The study involves a literature review and the analysis of various virtual tour offers in Switzerland to classify them based on the level of immersion, interactivity, and presence. The research findings indicate that the use of non-immersive 360° videos as marketing tools has diminished in value for tourist destinations, while immersive virtual tours for promotional purposes at trade fairs still hold some interest but are no longer considered a competitive advantage. However, the integration of VR into the on-site tourism experience has gained enthusiastic responses while also raising concerns among tourism stakeholders. This article stands out for its focus on VR usage by managers rather than customers and proposes a new structural classification of VR projects in Switzerland, offering practical implications for tourism and cultural organizations and suggesting directions for future research. The authors address the impact of VR on the tourism sector, especially in the Swiss context, and answer two key research questions: the types and characteristics of VR used in tourism and heritage in Switzerland and the motivations and limitations for companies, both public and private, to integrate VR tools into their strategies. They provide an overview of VR's presence, immersion, and sensory stimulation, which play crucial roles in transforming consumer behavior towards tourist destinations. The research concludes that while 360° VR tours have become less competitive, on-site VR experiences continue to generate interest among tourists, indicating that high levels of presence can drive visitor engagement. Moreover, the article suggests that as VR tours become more common in the tourism market, they no longer offer a competitive advantage to destination marketing organizations (DMOs). Still, experiential VR, integrated into the customer journey, is seen as a valuable approach by project managers, aligning with the notion that increased presence leads to higher visitor interest. Limitations of the study are recognized, and the authors suggest future research avenues, including the development of a measurement scale to gauge VR product effectiveness based on VR characteristics. This could be beneficial for optimizing the use of VR in the tourism and heritage sectors."[4]

- Research 4:
    - In the study titled "The Use of 360-Degree Virtual Tours to Promote Mountain Walking Tourism," the authors investigate how 360-degree virtual mountain walking tours influence individuals' intention to engage in real mountain walking. They conducted surveys with 320 participants who watched 360-degree virtual videos and found that the vividness of these videos positively influences the sense of presence, emotional involvement, flow state, and enjoyment, ultimately leading to an intention to participate in mountain walking tourism. This research employs the stimulus-organism-response (S-O-R) theory to analyze the relationships between these factors, shedding light on the potential of 360-degree virtual tours in promoting nature-based tourism. It provides practical insights for destination

marketers, virtual tour developers, and mountain park managers, suggesting ways to enhance the virtual tour experience and the development of mountain walking tourism.[9]

- However, the study has certain limitations. It focuses on a single tourist destination (Dinghu Mountain), which may limit the generalizability of the findings. Additionally, it only considers a limited set of emotional and psychological factors as the organism in the model, and future research could explore additional factors. Furthermore, the study exclusively evaluates the use of 360-degree virtual tours in head-mounted displays (HMDs), without comparing the experiences with other viewing devices.[9]

These research studies provide valuable insights that directly correlate with the development and marketing of TouriaVR, a virtual reality (VR) tourism application. They collectively highlight the growth potential of VR tourism, the positive outcomes of implementing VR technologies in the tourism industry, and the perspectives of tourism stakeholders. Furthermore, they stress the importance of enhancing accessibility, immersion, presence, and emotional engagement in VR experiences. By incorporating the findings and recommendations from these studies, TouriaVR can effectively position itself as an innovative and immersive solution that not only enhances tourism experiences but also aligns with the expectations of both users and tourism organizations, offering a valuable and competitive offering in the VR tourism market.

8. CONCLUSIONS

8.1 Conclusions

TouriaVR is poised to revolutionize the world of virtual reality (VR) tourism by offering an innovative solution that breaks down the barriers limiting traditional travel experiences. Through the utilization of high-quality 360-degree content and interactive features, TouriaVR provides users with an unprecedented opportunity to explore diverse destinations, all within the confines of their VR headsets. This comprehensive project has meticulously outlined its objectives, methodologies, design details, cost analysis, testing, and the invaluable insights drawn from recent literature. Guided by recent research, TouriaVR aims to not only meet but exceed the expectations of travelers, offering a cost-effective and highly immersive solution that addresses common obstacles to travel, including financial constraints, security concerns, health limitations, and bureaucratic complexities.

The strategic choice of Unreal Engine 5 as TouriaVR's development platform underscores its commitment to delivering photorealistic graphics and interactive content, setting a new standard for virtual tourism experiences. As TouriaVR advances, it remains dedicated to reshaping the future of travel. This project is at the forefront of a transformative wave, eliminating traditional travel limitations and providing a new benchmark for virtual tourism. TouriaVR is more than a

solution; it is the gateway to a future where the world is accessible to all, transcending the physical boundaries of exploration and redefining the way we engage with the world.

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