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Virtual Technologies for Tourism Promotion in Zimbabwe

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***Abstract*— Virtual Technologies can provide information visualisation and manipulation, and coupling such technology with virtual mapping can provide a promotional tool for geographic locations. Interest levels of particular historical and tourist sites are low as they lack the necessary promotion to become viable destinations, thus lowering employment and revenue potential. A high number of promotional tools exist and have been employed to create awareness of tourists, however, most have not quite grasped the imagination or attention of potential tourists. This paper aims to discuss the benefits of Virtual Reality to tourism promotion and go on to analyse and formulate a model framework for how to employ virtual technologies for geographic information through Web-based services that network millions of people together can promote tourism in Zimbabwe.**

Keywords—Virtual Reality, Tourism Promotion, Immersive Technology.

I. Introduction

This Virtual reality (VR), also known as immersive multimedia or computer-simulated reality, is a computer-generated simulation technology that replicates an environment, real or imagined. Three Dimensional (3D) immersive technologies provide users with an environment in which interaction is possible while creating an artificial sensory experience, which can include sight, touch, hearing, and smell. The experience seems very real to the person using such technology. VR has been growing rapidly over the years with widespread use in industries such as gaming, health and real estate. Over the past years, virtual reality has been used to promote and preserve tourist and cultural heritage sites. Many people consider tourism to be travelling for fun, enjoyment, or education, frequently in large groups. It might include excursions to tourist destinations, city breaks, business meetings, sporting events, or visits with friends and family. Our life and culture are not complete without tourism. Its economic prospects are essential to every country's sociocultural growth. In addition to creating employment possibilities, it aids in generating significant foreign exchange. The development of tourism helps achieve balanced and sustainable regional growth by employing unskilled workers specifically from the rural areas and also developing interior and remote areas. In Zimbabwe, the tourism industry contributes at least 13% of the GDP (Zimbabwe Tourism Report 2013).

Zimbabwe Tourism has been on a slow but steady rise after the near collapse and decade-long plague of an ailing economic environment. The introduction of a multi-currency system and major strides by the Zimbabwe Tourism Authority has contributed majorly to the revitalization of the tourism sector and its economic powers which are a major key to the country's broader recovery and an effective tool for development. Challenges that the industry still faces include (but are not limited to): a lack of digital information for tourists; a lack of technology-driven approach to marketing; inadequate motivation for tourism marketing. Promotion refers to raising customer awareness of a product or brand, generating sales, and creating brand loyalty. Promotion is key in any sector that has a product or service and in this case, tourist and cultural heritage sites are the main focus. Various tools can be used in the promotion of the vast number of tourist destinations in Zimbabwe and as such the aim is to develop another such tool which leverages the use of VR technologies.

II. Opportunities presented by Virtual Reality in Tourism

A. Destination choices

An immediate benefit of VR systems is the ability for customers to sample different destinations in advance. These experiences are paramount to informed decision-making. The European Travel Commission mentioned in their global trends report on tourism of 2006 that, "Marketing messages based on experiences and feelings will have a greater importance in travel decisions – what can you do at the destination and what will the personal benefits be?".[11].

B. Influencing customers to plan to travel

It is without a doubt that with existing web 2.0 technologies substantial travel information about a destination can be provided to the customer. This information can be used effectively to influence customers to dream. Dreaming is characterized by the development of destination images as influenced by word of mouth, recommendations, and/or previous experience which eventually trigger planning and ultimately booking as shown in Figure 1

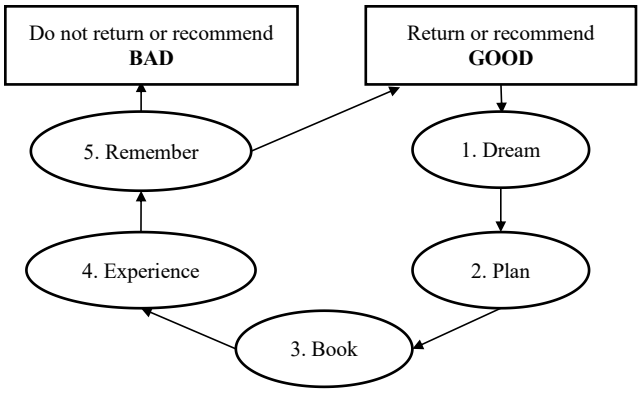

Fig. 1. The Customer Journey according to the UNWTO [13]

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C. VRs offer an exclusive emotional proposition

Human beings are emotional beings. A potential tourist's sense of comfort, mood, enjoyment, and peace about a destination and its values largely encourages them to visit. Companies that can offer a unique emotional proposition stand to differentiate themselves from the competition while also reaching a sizable target group in their marketing efforts as opposed to traditional marketing methods.

D. Attractions

Early in the year in 2016, Alton Towers theme park (UK), announced a re-theme of the park's existing Air ride to a new one where visitors can fly through space using Samsung Gear VR.[12] These new rides are similar in concept to roller coasters except more portable. Now is a perfect time for Zimbabwe to also invest in VR attractions, especially with the adoption of gaming technologies by the young.

E. Ease of access (virtual travel)

In as much as actual real travel is irreplaceable, there are many circumstances where access to a virtual world is much preferable. For example, some tourist destinations may be too expensive, or one may be physically handicapped and therefore unable to travel, or the experience may be too dangerous, also they could preserve attractions that have become extinct or no longer exist.

III. Literature review

Virtual Worlds are essentially about interactions. Interactions are quite different and unique compared to Web 2.0-based interactions which are solely between the interface and the user. According to Davis et al. (2005). These interactions are mainly carried out employing some character created to represent the users called "avatars". However, not all virtual worlds follow this approach but they still provide a reality in which one can still view and interact with the environment. The following approaches have been implemented concerning tourism.

A. 3D Geo-Spatial Virtual Reality System for Virtual tourism by V. F Balogun, A. F Thompson and O. A Sarumi in 2010

In 2010 Balogun, Thompson and Sarumi implemented a virtual tourism system using tourist sites in Osun State, Nigeria as a case study. The system was web-based and was an integration of Virtual Reality Systems (VRS), Geographic Information Systems (GIS) and dynamic web page technologies. The system was created to promote tourist places that were barely visited because of inadequate publicity.

The virtual reality components of the system which were used were created using Virtual Reality Modelling Language (VRML). This was used to create a 3D computer-generated representation of the scenery. They used VRML advanced features such as 3D scanning technology. The GIS components were used to provide geographically referenced information. The GIS was also used to create an interactive map of the tourist areas.

In what they referred to as a "hybrid" design, the architecture combined both the server-side and client-side technologies. In this design, the web server receives requests from the user through the web browser and responds with an HTML page as the HTTP response.

B. Luang Prabang virtual tour by Robin Letellier Heritage VR Group Canada

The Luang Prabang virtual tourism project focused on six 'Virtual Modules', whereby five of these represent key features within the city of Luang Prabang, and one remote Module, consisting of caves which are located 2 hours by motor boat from Luang Prabang. These six locations were included in a virtual reality room with a 3D high-definition display that featured a site visit scenario. With the help of stereo glasses and a closed, air-conditioned VR room, visitors to Luang Prabang are immersed in a 3D model of the location while they learn about its beauty, values, and vulnerability. The purpose of this virtual reality room might potentially be to educate tourists about the customs and culture of this part of the world.

C. Archaeological Knowledge and Information System (AKIS) based on Engelbourg ruined castle in Thann, Alsace, France, done by M. Koehl and N. Brigandin 2012.

By starting with a first virtual tour that contains roughly fifteen panoramic shots, they were able to transform the viewer into a true 3D interface using a variety of techniques. The user is provided with genuine interaction, which makes visualization feel nearly lively. Panoramic photos were produced after the selection of pertinent points of view. To fully comprehend the location, the initial virtual 3D model of the castle was also added in the form of panoramic pictures. Videos (as reports during the acquisition phases, during the restoration operations, during the excavations, etc.), digital geo-referenced papers, and other types of hotspots were utilized to connect the entire digital documentation to the site. The system's customizable interface enables users to go from one panoramic image to another, as is typical for virtual tours, or from a panoramic photographic image to a virtual panoramic image. Additionally, it enables the visualization of digital data such as old or new plans, cross sections, descriptions, instructional films, and audio remarks inlaid.

D. Kisnana-3D Virtual Tour by: i) Photography, photogrammetry (elevations, sections and floor plans): ART'V Mernoki Iroda (Jozsef Vajda Jozsef, Ilona Gyorfi) ii) Panoramic image post-processing, virtual tour and Software Development: 3dtour.eu (Csaba Lagany) in 2010

This project carried out in 2010 was financed by the EU. One part of this project was to create the first 3Dvirtual tour ever shot about a Hungarian castle. It not only documents the ongoing restoration process but also clarifies the building's history.

IV. Virtual Worlds: A Blueprint

To develop a virtual world or come up with a suitable form of application that aids in the promotion of any tourist destination, an accurate recording of three dimensions of the site should be recorded. By taking segments of the area to be promoted a virtual world can be realised by mapping real environmental elements onto the digital sphere. Figure 2 below shows the basic operation model of virtual worlds from a computer application view.

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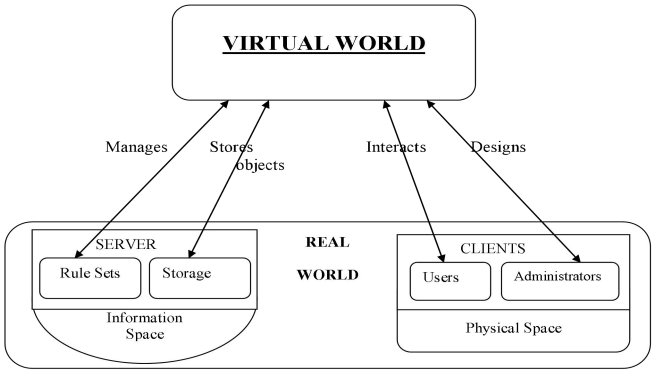

Fig. 2. Virtual World Model

The virtual world needs to be developed and deployed on a platform that can be accessible to users. Once deployed on a platform users can be able to access the virtual world, where they can be able to interact freely in the environment. Such environments usually have many users and the system tends to be deployed on a server platform from which clients can be able to access the virtual world simultaneously.

V. A Model for Developing a Virtual Reality of a Location

The stage of deployment comes well after the actual development of the virtual environment is achieved. Virtual Reality can be achieved by translating an accurate recording of the real world onto the digital sphere canvas (VR can be imagined, but not in this case). Virtual worlds will then require some level of interaction as they have to mimic those that exist in the real world. Three basic concepts should be followed to come up with the VR.

A. Modelling tools

a) A 3D modelling program is used to build virtual 3D things rather than a programming language. Here the environment and objects can be created using a powerful application such as Unity, Maya Autodesk, Blender, Google SketchUp etc. (all these programs allow the creation of 3D objects, scenes, views and illuminations). Either a series of keyframes and interpolation between them or a scripting language (Python) tied to the animated object, is used to produce animations. Using animation tools (Blender, Unity), it is possible to produce realistic and excellent virtual objects. It is left up to the digital content creator to choose a tool of choice for modelling putting into consideration the cross-platform rendering abilities of the 3D models.

B. Animation & Rendering

Within the 3D modelling program, a 3D model can be animated using keyframes or scripts. The programmed animation can then be played within the modelling application, or the content can be turned into a movie. Alternately, a 3D modeller can be used to create merely the shape of an object, which can then be imported into the 3D environment as a static object. Then, real-time animation and interaction will take place under the supervision of the application. Usually, the in-world method enables more complex animation and interaction logic than the modelling program itself. Real-time rendering in the networked multi-user environment of the 3D world is still a difficulty. The required methods can be obtained from well-known game creation tools such as Unreal Engine.

C. Scripting

Keyframe animations are pre-set in a specific pattern to do certain predetermined activities or animation sequences, this makes it difficult to interact with these objects as the only choice is between several pre-rendered keyframe sequences. An animated object will respond more adaptable to various input events if a script is attached, increasing flexibility. The performance of script languages when run by an interpreter is constrained, but they are helpful for straightforward interactions between objects and avatars. Compiler-based programming languages like C++ and Java offer the best performance and versatility. Here, pointers and data structures that can be accessed relatively efficiently could be used to indicate the relationship between items. Java and C++ offer a higher level of flexibility given their object-oriented approach which is highly suitable for the development of the virtual world, virtual mapping of real-world objects is easily carried on into the virtual sphere. An object-oriented approach can therefore be easily used to then add interactive abilities to the objects by defining instances of objects with additional attributes and methods (capabilities).

VI. Providing Interaction in Virtual Worlds

While modelling and animating provide the digital environment in which users can be able to view the world, it remains that some form of interaction is necessary beyond the static view or predefined animation sequences which may be present. To have a complete virtual world made up of interaction requires some analysis of certain models in the real world and then mapping these to objects within the virtual world and thus coming up with three basic Models:

- Object Model: This model explains the objects in a system and how they relate to one another. This approach ignores the dynamic nature of things and sees them all as static.
- Dynamic Model - This model shows how the system is dynamic. It depicts the alterations in the statuses of various objects as a result of potential system events.
- Functional Model - This model essentially explains how the system transforms data. Giving an overview of the fundamental interaction techniques accessible, this describes the data flow and changes that take place to the data across the system.

While the Object Model is most important of all as it describes the basic elements of the system, the objects and the environment, all three models together describe the complete functional system.

VII. Designing a Method of Testing the Virtual World vs the Real World

While the development of the virtual world is quite tedious requiring accurate mapping from the real world to the digital sphere when such development is done and completed there remains a need to test the accuracy of the virtual world. Since any location can be chosen and in this case, for tourist destinations and some heritage sites virtual mapping will be easy to test against real-world experience. In the case of

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commonly known destinations which in many cases are visualised or sensualised in various forms of media the task that remains is to get qualitative feedback from a sample group of users.

The sample group has to be as large as possible to get a clearer view of the effectiveness of the virtual mapping of chosen destination in the digital sphere (virtual world). Two main groups immediately emerge as good candidates for the sample of testers allowed to use the system with their feedback providing essentially different implications altogether. These two groups of testers required are the Former Visitors and the other group being the New Visitors (Potential Visitors).

Former visitors are those who have been to any of the areas of interest under development, the tourist destination, in person and have fully experienced every facet of the area. While there is some consideration that some of them may have not fully explored the area it is good to match their experience in the real world with what the virtual world is providing. This group of testers provide somewhat accurate feedback as to how the virtual world maps onto the real world and provides areas where necessary tweaks can thus be made.

Potential visitors are the other group that provides a different yet fundamental test point of the virtual world in terms of its ability to arouse interest. As users who have never experienced the actual location itself, they provide essential feedback on whether or not the application provides the required stimulation for them to visit the actual location. They provide feedback on the information that they would require before they consider visiting a place which can then be incorporated into the virtual world. This gives a clearer picture as to whether the development of such virtual worlds will provide some form of promotional media which can be taken up by the local tourism industry.

VIII. Implications of the Development of Virtual Reality model for Tourism Promotion

The main aim of this research is to expose a simple model which can be used in the development of a promotional tool for tourism in the country. The various technologies required for the development of such a tool have been highlighted as the model by which this can be achieved. The model proposed can be used on popular destinations within the country to not only promote such destinations but also provide an enhancement to the experience.

Virtual mapping provides an interactive guide for which users can be able to learn more about the location beforehand and give ground for sensitising them to some of the cultural and environmental artefacts that may be available in tourist areas of interest before arriving and /or while least at the location itself. This also makes the tourist aware of certain areas of interest or more so availability of certain facilities within the tourist destinations.

The overall result is that the model then provides more influence on the tourists' purchase decisions or interaction habits while they have visited these are immensely influenced through this model. This can ultimately influence major economic gains by increasing the number of visits to the destinations through a virtual world where interactions provided within the world mimic the real world and hence e-commerce opportunities are made available. Local players can also enter the virtual world and advertise their services and also sell products which can be shipped to users who may not be able to afford travel but have an interest in the items they see. This model serves as a promotional tool for tourism where potential tourists can gain a more unconventional understanding of the different facets of specific tourism destinations.

A lot of effort however has to be put into the provision of the enticing and accurate overall look and feel of virtually mapped worlds, giving high consideration to the render quality of the environment. This if not done to a High Definition standard may take away certain detailed aspects that are necessary to show or that may be the cornerstone of some locations. This may mean that the virtual world requires to be deployed on a platform with higher specifications and thus making it less robust as it may limit the number of users who can access the virtual world.

Generally, the translation of the system to multiple devices is ideally what is required for it to be a powerful promotional tool as users should not be hindered in the way how they manage to access the application. This means it can be brought to the doorsteps of every individual with access to the internet as most promotional media does.

IX. Conclusion

In conclusion, virtual mapping of tourist destinations provides an additional means of promotion of such places and also provides a tool for the preservation of certain aspects that are being eroded with time. Mapping a real-world environment onto a virtual one requires a high level of precision to attain the required result of providing a close-to real-life experience. While applications such as Google Earth have gained more ground in the development of 3D worldview, it still has most locations in Zimbabwe left out as they may not be on areas of focus. By developing an area-by-area application for each of the tourist attractions and heritage sites in the country these can, later on, be consolidated into a single application for information centres around the country. There is also a need to provide multiple platform accessibility of virtually mapped environments to make it more viable as a promotional tool and this can be achieved through new gaming and web technologies making it accessible to all devices with an internet connection.

Whilst the study has maintained the development of a simple virtual mapping model to closely couple with the expected real-world experience, the ever-changing digital sphere has provided even more avenues such as e-tourism of semi-fictional realities and augmented reality in actual tourist destinations, creation of virtual quest to be completed in the real world; all of which can be used in the development of tourism.

References

[1] Dreher, C., Rieners, T., Dreher, N. and Dreher, H. 3D Virtual Worlds Enriching Innovation and Collaboration in Information Systems Research, Development and Commercialization, Proceedings of 3rd IEEE International Conference on Digital Ecosystems and Technologies, pp. 168-173 (2011)

[2] Daniel A. Guttentag. Virtual reality: Applications and implications for tourism, Tourism Management, Volume 31, Issue 5, Pages 637-651 (2010)

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[3] Messinger, P.R., Stroulia, E, Lyons, K. Virtual Worlds Research: Past, Present & Future, Journal of Virtual Worlds Research, vol.1, no.1, pp. 2-18 (2008)

[4] Wegener, M., McIntyre, T.J., McGrath, D., Savage, C.M., Williamson, M., Developing a Virtual Physics World, Australian Journal of Educational Technology, 28 (3), pp. 504-521.

[5] Application of Virtual Reality in Tourism Management Professional Teaching Shi-chen Fan, Feng-xia Wang

[6] Wood, D. and Willems, J., Responding to the widening participation agenda through improved access to and within 3D virtual learning environments, Australian Journal of Educational Technology (2012)

[7] Desktop Virtual Reality for E-Learning Environments by C Katterfield and M Sester, Luang Prabang virtual tour by Robin Letellier Heritage VR Group Canada

[8] Koehl, M. and Brigand, N, Archaeological Knowledge and Information System (AKIS) based on Engelbourg ruined castle in Thann, Alsace, France (2012)

[9] Kisnana-3D Virtual Tour b:Photography ,photogrammetry(elevations, sections and floor plans):ART' Mernoki Iroda(Jozsef Vajda Jozsef,Ilona Gyorfi)Panoramic image post-processing, virtual tour and development:3dtour.eu (Csaba Lagany)

[10] Robin Letellier, "Virtual Reality: A New Tool for Sustainable Tourism and Cultural Heritage Sites Management"

[11] European Travel Commission [ETC]. ETC Tourism Trends for Europe. Belgium (2006)

[12] Smerdon, J. Alton Towers Announce Virtual Reality Rollercoaster. http://vrrelated.com/alton-towers-announce-virtual-reality-rollercoaster/ (2016).

[13] UNWTO. A practical guide to tourism destination management. Madrid: World Tourism Organization (2007)

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