Virtual Reality Technology and Simulation Technology to Development of Smart Travelling in the Time of Industrial Revolution 4.0

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Abstract

The push of levers of digital boom technology in the era of industrial revolution 4.0 has created great impetus for economic development, especially in maintaining and revitalizing the smokeless tourism industry. That makes even more sense in the context of the current covid 19 pandemic and increasing social distancing. It can be said that the appearance of the COVID-19 epidemic has adversely affected the economy, fundamentally changing people's living and consumption behavior. Meanwhile, business sectors are facing the risk of production shutdown because of capital flow downturn, idle operation or bankruptcy because of covid19. The reason for social distancing forces people to not be able to travel freely to carry out travel and shopping behaviors like before. Previously normal activities were restricted from being concentrated in large places, leading to a business industry that was supposed to be super-profitable and a major contributor to a high GDP structure such as tourism, which is facing a dilemma. The tourist season is coming, but the number of tourists suddenly drops because of social distancing. That risk poses a big obstacle to the tourism industry, but it will be an opportunity if we know how to take advantage of the 4.0 technology revolution. That will help make use of smart digital technology applications to exploit and
develop different types of tourism. Research and propose ideas to apply VR technology to develop smart tourism industry, helping tourists from all over the world can use and experience famous tourist attractions of Vietnam. VR virtual reality technology allows to maintain and develop tourism activities in the context of the current pandemic.

Keywords

Smart Travelling, Virtual Reality, VR Technologies, Virtual Museum, 3D Technology.

JEL: M30, M37, Q26, M38.

Introduction

Smart traveling in Vietnam has only been interested and strongly promoted in the past 5 years. The development of smart tourism is associated with the reality of the development of Vietnam's tourism and the process of approaching the 4th Industrial Revolution. Application smart travelling is currently a solution being actively implemented today to meet the requirements of tourism digitization. Especially the needs of visitors to visit, learn and experience in the process of accessing the achievements of the 4th Industrial Revolution. Virtual reality technology and 360 video have been applied to 16 monuments in Thai Nguyen, Vietnam.

Digital transformation is spreading and affecting all aspects of economic and social life, attracting the attention of all actors in the economy. Data is considered a very important issue, is the source of energy for digital transformation, is considered a new resource for the birth and development of the digital economy. For the tourism industry, one of the industries that owns a large amount of data, and is also the leading industry in the journey to transform the operating model towards digital trends, data management becomes a vital issue, creating new consumer trends for people. The advantage will belong to enterprises that know how to rise to capture and master data sources through intelligently managing and using them on the basis of application of new scientific and technological achievements. The speed of market development as well as new technologies have posed great challenges for the tourism industry. The tourism industry needs to develop policies and market orientations in order to take full advantage of digital technology opportunities to develop the tourism industry.

Virtual reality is a fairly popular technology application that is exploited to improve the efficiency of the discovery and storage of resources for the development of the tourism industry. This is a three-dimensional environment generated, synthesized and controlled through computers for the purpose of simulating the real world or a world according to
human imagination. VR technology allows users through peripherals and transducers to interact with the things and actions of the virtual world like interacting with the events and actions of the real world. From there, it helps people to recreate relics, especially historical sites that have been deformed and worn in the past to create the same values as in real life. That allows the beneficiary or visitor to be able to teleport an object in the virtual world, or to be able to feel an object when touching it. Peripheral devices will do the job of translating user activities into the transducer, which then converts these signals into interactions into the virtual environment. At the same time, the environment also transfers its effects to the transducer and the converter passes to the peripherals, which then affect the user. The above devices have been developed and are being developed more and more completely, new technology increasingly introduces more and more modern devices that allow people to get closer to virtual reality, such as: data gloves, data shirts and three-dimensional input devices such as 3-D scanners, 3-D cameras, etc.

Virtual reality is a 3D environment and uses a large amount of graphic information to recreate and recreate tourist landscapes. These tourism resources may still exist or have been lost over time. But they will be rendered in 3D. For practical applications it is not possible to use the usual methods of accessing the graphics memory, but must use the direct memory access method and use the graphics accelerator. Therefore, we need software to directly access memory and control the acceleration of graphics devices. Some software standards are commonly used today such as DirectX, OpenGL, MiniGL.

To recreate, recreate the tourist landscape, people can use peripheral devices. These devices used in the field of virtual reality are increasingly modern and diverse. A typical example is the HMD (Head-Mounted Display) system. The HMD system consists of two screens that attach directly to the eyes, allowing tourists to see and feel the virtual world as if it were a space in the real world. From there, the system will calculate your perspective and position in the virtual world.

Tourist landscapes can be modeled after the sequence of activities of a real-world process or system during its lifetime. Simulation technology can be used to describe and re-analyze system operations, to give the most realistic representation of what is happening in the real world. Simulation technology can be performed on a computer to create models created through programming based on VR technology.

In 2016, the online travel exchange (Tripi) in Vietnam allowed the transaction of package tours, hotels and flight tickets. Moreover, Tripi also allows customers to search for points,
prices and compare with other travel products. Even, the online travel trading platform Tripi also allows tourists to accurately update the status of tourism products and services 24/24. IVIVU website (ivivu.com) is also emerging and becoming one of the major travel exchanges, allowing tourists to find information, compare, choose, make tour bookings, buy Air tickets, hotel reservations. This website allows displaying more than 300 tours, more than 5,000 hotels in Vietnam and 345,000 hotels worldwide for visitors to choose and refer to.

In 2008, the group of authors Huan.NV in the study of Simulation of Temple of Literature, based on VRML virtual reality technology (running on 3D web environment, deployed and produced simulation results at the Temple of Literature at the Temple of Literature). Tu Giam is based on VRML virtual reality technology. Simulation of the One Pillar Pagoda relic and tourism development (2009). Research on 3D display technology and simulation application of Thap Luong, Laos (2017). Research on 3D display techniques in simulation of some monuments of Hung Temple, Phu Tho (period 2019-2020). Thereby, the exploitation and application of virtual reality technology to develop the above virtual simulation applications will give people and visitors interesting and attractive experiences about historical - cultural relics chemical. Citizens and visitors can virtual tour, interact and immerse themselves in historical sites using VRML simulation technology.

In Vietnam, the application of virtual reality technology to the construction of virtual museums is quite strong. That is implemented through the Government's overall project to build a 3D interactive virtual museum, specifically: Virtual Museum - National Museum of History; Virtual Museum of Vietnam Military History; Vietnam Virtual Museum of Ethnology, Quang Ninh Virtual Museum,… Virtual museums applying 3D reconstruction technology will help enhance the experience for tourists and attract the attention of many visitors.

**Methodology**

Authors not only use experiences, observations but also use qualitative methods, with synthesis and explanatory methods, combined with historical and dialectical materialism analysis methods. Authors also use some research methods, including document analysis, pedagogical observation, qualitative analysis, synthesis, dialectical materialism and explanation methods.
Main Results

1. Application of VR Technology in Development Smart Travelling

The use of simulation technology brings many advantages in making applied decisions in economic sectors, especially tourism. Simulation technology allows testing without breaking the existing system: With an existing system, a new idea that is intended to be applied can be very difficult, expensive, but sometimes not feasible. Simulation technology helps people create a model of tourist populations or landscapes that accurately reflect the existing system. People want to change the shape and outer nuances to resemble reality or create tourist landscapes according to our thoughts. This can be done on the virtual reality model and check all effects on the model. Changes in new tourist populations or landscapes are put into practice, ensuring that there are no mistakes that could break the old system. Simulation technology allows us to test theories before installation. Computer simulations will allow theories to be tested before a new system is installed or built. This check will allow unanticipated design flaws to be identified. From this test result, the designer can fix and improve the system before installation. Also with these mistakes, if only discovered after setting up the system, the cost of fixing it will increase very high, even unusable.

Simulation technology allows us to recognize unforeseen problems. When a landscape system or tourist complex is simulated before installation and programmed according to calculations, the model is often improved to be able to simulate in more detail at the beginning. When we start to simulate a certain landscape or tourist population, the knowledge about the system is often dispersed depending on the perception of each individual. Therefore, when developing a model of the system, those discrete pieces of knowledge must be collected to form an overall picture of the system. The process of understanding the system through the model, in addition to the general knowledge from others, we can learn more deeply about the activities and interactions of the system with the external environment.

VR is a simulation system with two-way interaction and real-time processing. With stereo 3D technology, visitors will be immersed in the virtual landscape space. Building a VR system that reproduces a certain landscape or tourist population, building a 3D model is the first important step. Generally, there are 2 trends to perform 3D model simulation: The first is rendering 3D models through traditional programming languages. This way does not require a race in technology as well as a strong configuration of hardware, which can perform complex simulations that require high accuracy. This job is quite complicated.
because it requires a high level of programming, complex algorithms, takes a lot of time and is especially difficult to create large scenes. But if we want to accurately simulate natural phenomena according to their nature, we should use VR technology. VR technology is used to simulate small-scale tourist populations or landscapes, suitable for single experiences. The use of built-in simulation tools is very suitable for tourists who want to visit virtual tours because it does not require a high level of programming and does not take much time to implement. This is suitable for simulations whose modeling properties do not require high accuracy.

2. The Essential Requirements of the Graphics Hardware

The hardware components of an interactive graphics system include: - CPU: Helps support the execution of application programs. - The processor displays the landscape or tourist complex System Memory: Contains currently executing programs and data. Graphics Package: Provides graphical functions for application programs. - Application software (Application Program): helps to provide application graphics software. Frame buffer: helps provide the displayed images. - Video Controller: helps control the screen, converts digital data in the frame buffer into bright spots on the screen.

![Interactive graphics system hardware requirements](image)

3. Virtual Reality Technology in Tourism Development in the 4.0 Era

Application of Virtual Reality Technology in Development Smart Travelling in some Countries around the World

Virtual reality technology platform is one of 10 strategic technologies of Gartner (global market research organization), developed based on 3D application. Virtual reality glasses
are applications from very popular technology, used in many different fields. However, VR technology has recently been interested in the field of tourism and entertainment. VR technology allows users to feel the images on phones and mobile devices that are simulated as real compared to real life. But through a multi-dimensional lens, tourist images and landscapes may be more vivid than in real life. In addition to viewing multi-dimensional images, users can also feel and interact with those images, or directly transform into a character in the "virtual world" to have the same mood as the real thing.

In the field of tourism, the issue of preserving and embellishing tourist landscapes or revolutionary historical sites for the development of entertainment, sightseeing and resort tourism is currently being concerned. For a tropical country like Vietnam, although the tourist landscape is quite diverse, it has been severely damaged. That destruction can be caused by tropical nature that makes the landscape moldy, easy to break down, or wear out over time. Or it can also be due to war distortion, loss of cultural and tourist values.

Therefore, promoting the value of historical sites in tourism development and promotion is a problem that has been receiving the attention of many managers, scientists as well as experts in tourism interdisciplinary field of Heritage - Culture - Tourism. The promotion of the value of historical relics in the development and promotion of tourism of each country in the world and Vietnam in order to preserve and promote, educate the revolutionary tradition of ancestors, promote and develop economic development of the country. In particular, the value of historical monuments has been and will contribute a lot to the education and tourism development of each country when the length of history and monuments becomes more and more thick.

Stemming from the subjective and objective impacts of people as well as climatic and environmental conditions, historical and cultural relics of mankind and countries around the world have been increasingly lost wear and tear, difficult to keep intact as inherent. In addition, the preservation, embellishment and promotion of strengths and advantages from the values of historical relics brought to people and each country have not been fully promoted, not yet exploited advantages. In order to maintain, preserve and promote the values of their historical-cultural relics to the people of their own countries and to friends and tourists all over the world, each country has had many solutions to improve the efficiency of conservation, embellishment and promotion of the values of historical-cultural relics. Countries around the world have focused on research, development, and application of new 3D technologies (virtual reality technology) in building digitized systems, simulating heritages, historical and cultural relics its own. The
simulation can be in the form of virtual systems, such as virtual museums, historical and cultural landmarks, etc.

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Virtual reality technology is a new technology that makes it possible for us to simulate, restore and recreate the physical objects, artifacts or human activities, the real world in the most honest way. Virtual reality technologies such as Unity 3D, VRML, Morfit 3D, Maya can allow us to scrutinize every detail of ancient artifacts, artifacts or stunning landscapes, feel every crack, even discover extremely subtle details that if enjoyed in the real place with the attitude of a mere visitor, it will not be easy to experience. The application of virtual reality technology to building 3D simulation systems of historical monuments will help introduce a certain value and cannot replace real relics. However, the 3D relic simulation system will be a positive support for the real monument because the information on the 3D monument will arouse curiosity for the viewer making them want to go to the monument to see the reality.

The method of applying virtual reality and 3D technology in the world has been applied by many countries for a long time, but mainly applied to building a virtual museum system. In France, there are dozens of scenic spots that are historical and cultural relics, museums have applied 3D technology and virtual reality to build virtual simulation systems like historical sites. Virtual revolution, virtual museum (Louvre). Or as in India, most of the historical-cultural relics and scenic spots have been virtualized, using virtual reality technology to build a virtual simulation system to promote images, historical and cultural values of the country, for example Vishnu III Temple, Hampi, New Delhi, India.
Italy has also researched and implemented the application of virtual reality technology to build Vatican virtual museum systems to bring people changes in tourism, being able to visit virtual museums like real museums thanks to into digital technology applications.

Currently, in India, there are hundreds of places including mainly temples, De Saraswati in India, historical and cultural relics.

![Figure 2 3D simulation of Saraswati Theme in India (source: internet)](image)

**Application of Virtual Reality Technology in Development Smart Travelling in Viet Nam**

Vietnam is a country with a long history of heroic revolution. Over 4000 years of history, Vietnam has formed a priceless historical treasure. The preservation, creation or embellishment and promotion of the value of relics in general and revolutionary historical sites in particular are of great significance not only to historical development but also to the exploitation of natural resources for tourism development. Currently, the conservation and promotion of values from historical sites have not been paid much attention. In economic sectors, tourism is considered a smokeless industry, creating great value for society and improving and enhancing people's lives. In areas with many landscapes and monuments, it is even more meaningful. But really, they are not currently considered as strengths contributing to the socio-economic development of localities. In Dien Bien, the service to visit component relics far from the city such as Muong Phang, Na Nhan is still open. Security guards, tour guides sometimes do not fully understand the component monuments, basic foreign language skills to introduce to foreign guests are not fully equipped.
In order to improve the efficiency and further promote the conservation, embellishment and restoration of historical - cultural relics, a combination of solutions is absolutely necessary. In addition to the above approaches to preserving, embellishing and promoting historical values, there are now studies on the application of virtual reality and 3D technology in the field of simulation. This is aimed at preserving, reproducing and embellishing historical relics and promoting the value of historical and cultural relics in revolutionary traditional education, tourism development and promotion. VCCorp Joint Stock Company, 2018 has launched the Dien Bien Phu 7554 Victory Game application, the main content of the game is to simulate some attacks, space, ... taking place at the A1 Hill relic. Through Game 7554, the system simulates and recreates the history of Hill A1. This can help players visualize and visualize the history taking place at the A1 Hill relic, contributing to preserving and promoting the value of revolutionary history. Toan Dung Media Joint Stock Company has focused on researching technology solutions to develop virtual simulation systems for relics. According to ToanDungMedia Company, the wear and tear of time, the influence of surrounding environmental factors make historical relics seriously degraded, and even in danger of disappearing because of weak facilities. The most effective solution to preserve historical relics is 3D Scanning technology - the world's most advanced technology that allows to restore space in a realistic and sharp way. Digitizing heritage with 3D Scanning technology promises to become a tool to preserve and promote the good images and traditions of Vietnam. The system of heritage-historical relics has great material and spiritual value and is an invaluable
resource of the country of Vietnam. That has very important meaning, helping people know their roots, understand the richness of history, understand national traditions and influence the formation of human personality. As information sources on television and newspapers report on historical sites that are severely degraded and even in danger of disappearing, is there any solution that can overcome this situation? Currently, most people, especially young people, do not like to visit historical sites for a variety of reasons. The development of information technology makes different modes of entertainment more attractive. This causes people to be attracted to and no longer like the old things, which really corrodes the traditional things. Digitizing heritage with 3D Scanning technology appears as a miracle to remove all these concerns. Currently, Toan Dung Media has developed a number of applications to simulate the following historical sites: Dai Hung Bao Dien- Ba Van Pagoda; Hoi An; Monuments of Tien Le Temple (Hoai Duc - Hanoi); Temple of Literature Quoc Tu Giam and Bai Dinh Pagoda. Thereby, residents and tourists can visit the virtual monument in the virtual tour room, then go on a real tour. This will help visitors have a new experience in sightseeing, stimulate the curiosity of visitors. Along with the above research direction, there is W2G Simulation System and Technology Development Joint Stock Company, a unit that also has a long history of researching and deploying applications in the field of simulation. This company has also released the results of research and application implementation such as the topic of "Simulating the space of Hanoi's Old Quarter", "Van Mieu Quoc Tu Giam”. With this product allows visitors to interact while observing the scene. The technology used is detail hierarchy and Importor to speed up scene rendering. This technique is based on the idea that if objects are far away, the observer cannot distinguish them from the flat image representing themselves. In that case, flat images of 3D objects can be used for representation. Selected platform graphics library of the open source community to reduce the cost of building projects.

**Conclusions**

Smart travelling focusing on the benefits of tourists but ensuring the lowest cost, safety and convenience on the basis of technology application and use of modern equipment, global information and data. Currently, virtual reality simulation technology, 3D technology can be used to exploit and develop applications in different fields. The formation of virtual museums applying 3D reconstruction technology will help improve the experience for visitors. The difficulties that the museum is facing will be solved with the advantages of a virtual museum such as: no need for a large display area, no time limit to visit, no need to preserve artifacts and even no need for directions tour guide, no interpreter needed. The advantage of this technology allows that anything that is visible in
real space can be modeled in virtual space. Dynamic and physical interactions in real space of things, artifacts, entities, sounds, images, objects can all be simulated thanks to this technology. Virtual museum solutions allow visitors to easily access and explore, select objects and topics of interest and interest, visitors freely explore the museum like a real museum holder. In addition to the projects of developing virtual applications in digitization and building virtual museums, there are also emerging research groups that are oriented to develop simulation applications to support the guide of attractions tourism using 3600 technology, flycam like Viettel's model - A1 Hill travel guide. The technology or application will guide visitors to visit the current space of the A1 Hill monument. However, there are limitations that do not support visitors to experience as real people, do not experience walking in the trenches, tunnels do not reproduce historical events.

The technology or application will guide visitors to visit the current space of the A1 Hill monument. However, there are limitations that do not support visitors to experience as real people, do not experience walking in the trenches, tunnels do not reproduce historical events. Thus, the issue of preserving, embellishing, restoring and promoting the value of revolutionary historical relics in the country has received a lot of special attention from the Party, the State, and agencies at all levels from the central government to the local, scientists and experts. The research has suggested how to use a combination of methods and approaches in exploiting and deploying new technologies such as virtual reality technology, 3D technology. That helps to support the conservation, embellishment and promotion of the value of monuments and tourist attractions. This will help localities exploit their inherent strengths to serve economic development on the basis of taking advantage of the technology platforms of the digital revolution in the current context. And Huy, D.T.N, Thanh, N.T.P et al (2021) stated in the era of IoTs there are applications of various industries including tourism to develop. While Huy, D.T.N (2015) also mentioned corpoate governance standards for sustainability of firms.

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References


