

**INOVATIVNI PRISTUP STVARANJU VISOKO
PERSONALIZIRANOG TURISTIČKOG ISKUSTVA
KORIŠTENJEM NAPREDNIH IT TEHNOLOGIJA**

**INNOVATIVE APPROACH FOR THE CREATION OF
ENHANCED PERSONALIZED TOURIST USER EXPERIENCE
WITH ADVANCED IT TECHNOLOGIES**

Tomislav Bronzin¹, Brigita Prole¹, Arian Stipić¹, Klaudio Pap²

¹ CITUS d.o.o., Baštijanova ulica 52A, Zagreb, Hrvatska

² Sveučilište u Zagrebu, Grafički fakultet, Getaldićeva 2, Zagreb, Hrvatska

E-mail: tbronzin@citus.hr; brigita@citus.hr; arian@citus.hr; kpap@grf.hr

SAŽETAK

Turizam se u svojoj suvremenoj fazi nametnuo kao jedna od neprepoznatljivijih društvenih i ekonomskih grana. Sve zahtjevniji turisti traže novo, jedinstveno i pamtljivo turističko iskustvo. Ovaj rad govori o mogućem pristupu unaprjeđenja turističkog doživljaja upotrebom naprednih IT tehnologija poput umjetne inteligencije (AI), virtualne i proširene stvarnosti (VR i AR), koje će postati neizostavni dio svakog turističkog proizvoda. Te tehnologije omogućavaju stvaranje konteksta komunikacije između čovjeka i računalnog sustava, kako kod verbalne tako i kod neverbalne komunikacije, što omogućava visoki stupanj personalizacije iskustva turista. U ovom radu predstavljeni su modeli za stvaranje novih vizualnih/grafičkih korisničkih sučelja za komunikaciju čovjek-računalo u turističkoj industriji.

Ključne riječi: umjetna inteligencija (AI), proširena stvarnost (AR), virtualna stvarnost (VR), grafička komunikacija, turizam, turističko iskustvo.

ABSTRACT

In its contemporary phase, tourism has established itself as one of the most recognizable social and economic branches. More and more demanding tourists are looking for a new, unique and memorable tourist experience. This paper presents possible approach to enhancing the tourism experience by using advanced IT technologies such as artificial intelligence (AI), virtual and augmented reality (VR and AR), which will become an integral part of any touristic product.

These technologies enable the creation of a context of communication between humans and the computer system, both in verbal and non-verbal communication, which enables a enhanced personalization of the tourist experience. This paper presents models for creating new visual/graphic user interfaces for human-computer communication in the tourism industry.

Keywords: artificial intelligence (AI), augmented reality (AR), virtual reality (VR), graphic communication, tourism, tourist experience.

1 INTRODUCTION

Tourism is one of the largest and fastest growing sectors in the world economy. It plays a key role in job creation, export revenue and domestic value added. Tourism is a vibrant, dynamic, competitive, fragile and growth-oriented industry. Value, importance and impact of tourism industry, in every country, is very high by its contribution in the overall growth and development of the economy of a country and also in progress of the society and social structure of a country. Tourism industry operates through a vast network of inter-connected and related industries as well as other ancillary industries which aim to serve the tourists.

The tourist's satisfaction, safety and unique experience are the essence of tourism businesses. The tourism industry is changing due to new generation of tourists and their expectations, needs and habits and due to development of new technologies and gadgets. The new generation of tourists, known as emerging generations, is on the horizon. It is generation Z (born in the period late 1990s – early 2010s) and Millennials (born in the period early 1980s – mid 1990s). These generations have grown up with technology and the Internet. They are very challenging and demanding demographic groups, compared to previous generations, since they are growing up with the quick and direct access to information enabled by digital technology. Therefore, technological innovations are dramatically transforming the face of tourism. Artificial intelligence (AI), virtual, augmented and mixed reality (VR, AR and MR) and graphic communication are taking tourism industry in the new era.

Sustained development of the tourism industry depends on its ability to adapt to emerging economic, social, political, environmental and technological trends. Tourism is a dynamic and competitive industry that requires the ability to constantly adapt to tourists' non- stop changing their interests. Consequently, we can identify two sides of tourism industry: the demand side and the supply side.

It is widely adopted that there are three very important tourist experience phases for both sides: **pre**, **during** and **post** phase^[1] (also frequently labelled as **anticipation**, **consumption** and **memory** phase^[2]) of the travel process. This paper extends this concept and introduces the fourth, **marketing phase**, that precedes previously mentioned ones.

2 TOURIST EXPERIENCE PHASES

We believe that the old, three-phase representation of the tourism experience is no longer accurate enough and the primary reason is the rapid advance of various IT technologies that

already have a huge impact on virtually every aspect of society. Therefore, we propose a new, slightly modified, four phase representation as follows:

- Phase 1: **Marketing**
- Phase 2: **Planning**
- Phase 3: **Visiting**
- Phase 4: **Memory preservation**

Marketing phase precedes all other phases because it creates the interest and attracts potential tourists to a region, country, city and individual offerings in various areas of interest (culture, sport, leisure, entertainment, gastronomy, adventure, medicine, education etc.). Many people are interested to learn about these elements but only a limited number will actually visit the presented region, country, city or amenities. Therefore, the final economic outcome (financially successful year or a season, for example) for most tourist organizations will heavily depend on the successfully planned and executed marketing phase. From a supply side perspective, this is a pure investment phase that has three main goals:

- Present the existing offerings
- Raise the level of individual interest for those offerings, and
- Generate new tourists that will actually visit proposed places

During the marketing phase, main efforts regarding the implementation of advanced IT solutions are aimed to improve the general image and create positive sentiments, usually targeting wider areas like cities or even entire countries. However, individual offerings also intensely participate in this phase while trying to improve their visibility and differentiate themselves from other similar offerings.

Planning phase (also frequently called *anticipation phase*) starts when a potential tourist makes the decision about his/hers targets and wants to plan the visit or a journey. Depending on the location, duration and specific interests, the visit, trip or journey may need some planning before a tourist actually gets there. This planning not only includes a list of places and amenities to be visited, but also depends on precise and very detailed local information about traffic and transportation or any other rules that may apply.

The final result of the planning phase might be a detailed daily plan together with all other useful information that can be made available on the mobile device that a tourist will take with him. This plan should have as many live links to specific services (not just sites!) that may be needed, for example buying different types of e-tickets for transportation or admittance.

Visiting phase (also frequently called *consumption phase*) covers the actual visiting time and all associated activities during the visit or a journey. From a supply side perspective, the majority of efforts regarding the implementation of advanced IT solutions are left to the individual targets (museums, theaters, sport venues, adventure tours, amusement parks etc.) and serve three main goals:

- Providing clear guidance and instructions for visiting the specific place, institution, venue or attraction
- Creating enhanced (in most advanced cases even interactive) experience unique for that specific place, institution, venue or attraction, and
- Generate appropriate personalized data that a tourist might use later (in the next phase) to create comprehensive digital memorabilia

Memory preservation phase (also frequently called *memory phase*) starts simultaneously with the previous, visiting phase, and continues after the visit has been completed. This phase has two main goals:

- Collecting digital memorabilia (images, videos etc.) from the visit, trip or journey, and
- Organizing individual digital artifacts into comprehensive “memory sets” suitable for occasional reviewing and sharing with others

Obviously, individual digital artifacts may be directly generated by the tourists (by using their mobile phones, photo and video cameras and similar gadgets) or could be individually generated by the specific places, institutions, venues or attractions during the visiting phase and made available either by directly sending them to a specified e-mail or accessible through a download. Organization and presentation of digital artifacts requires some kind of an application capable of doing it. This application can span a wide area from very simple ones with limited functionality and fast results (intended for mobile devices, for instance) all the way up to reasonably complex ones that provide enough features to encourage advanced creativity and usage of diverse data sources.

Some specific tourist areas already offer many excellent applications that qualify for the memory preservation phase. Probably the most advanced ones available today are covering cycling and trekking tours and practically everything related to them where products like **Strava** (<https://www.strava.com/features>), **MyWindsock** (<https://mywindsock.com>) or **Cyclemeter**, **Map My Ride**, **Komoot**, **Viewranger** or **Trailforks** (all available as individual downloads for mobile devices) immediately come to one’s mind.

3 THE ROLE OF ADVANCED IT TECHNOLOGIES

Just like almost any other segment of economy, tourism is also undergoing the significant digital transformation and it is clearly visible in areas like selection and reservation of hotels and other types of accommodations where platforms like **Booking** (<https://www.booking.com>), **Airbnb** (<https://www.airbnb.com>), or **Trivago** (<https://www.trivago.com>), have already globally disrupted the entire market. Still, they are covering only a limited part of the entire experience acting as mediators between supply (typically accommodation providers) and demand side (tourists). This still leaves huge opportunities for all other types of implementations in all four (4) tourist experience phases.

Depending on the specific tourist experience phase, different IT technologies can be applied to create advanced and rich personal experiences. All of them will have to involve a lot of data but clearly, the visual component (the way the underlying data is represented) is the key to success. The key point in creating rich tourist experience is the level of integration of different technologies and services. Depending on the complexity and maturity of the specific solution, functionalities may go well beyond the pure visualization (like graphs, photographic images or videos) and even include dynamic interaction with the visual content. For example, this interaction can utilize chatbots, advanced geolocation and mapping functionalities, integration with GPS features widely available on mobile devices, integration of external data available on specialized external services or incorporation of virtual, mixed or augmented realities.

Previous examples are not the only possible (and desirable!) ways of implementing advanced IT technologies in the tourism industry. Generally, there are several main categories of usage:

- Strategic and analytical tools
- Marketing and education
- Booking platforms
- Personal interaction

Strategic and analytical tools should be used to model, analyze, simulate and predict developments of the local and global industry trends. Key technology here is Big Data combined with machine learning and available analytical tools in custom solutions. This category is internal, interesting primarily from a macro perspective and therefore not directly accessible or even visible to individual tourists.

Marketing and education solutions should be implemented in the first, marketing phase of the tourist experience. It has both short-term and long-term purpose of providing globally easily

accessible, relevant information using the most engaging technologies and intense user interaction. Key technologies here are 3D visualizations, advanced geolocation and mapping functionalities, virtual and mixed reality and the preferred delivery channel is internet browser.

Booking platforms are widely present for several years and they are probably most advanced tourist-related platforms available today. They support a lot of features and make the reservation experience completely different that it has been 10 years ago. Also, they are truly global because they are available everywhere and they provide accommodation resources across the globe. Finally, it is fair to say that booking platforms have been the trigger that started powerful digital transformation in tourism. Key technologies used by these platforms are relatively simple and primarily rely on combining standard visual elements (images, videos and occasionally 3D visualizations) and advanced geolocation and mapping functionalities and the delivery channel is internet browser.

Personal interaction is the rarest category that promises the richest contents and creates long-lasting impression on tourists but also requires the most preparations for success. This is where imagination can really create very advanced solutions that are highly customized for a specific location. Key technologies used are bots, IoT, advanced Wi-Fi with beacons, various multi-media and holographic devices, stereoscopic cameras and elements of artificial intelligence like robotics and virtual, mixed and augmented reality implementations.

4 CHALLENGES OF NEW TECHNOLOGIES

According to the definition from the **Encyclopedia Britannica**^[3] *“Artificial Intelligence (AI) is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.”*. The same source states that the term “AI” is also *“... frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience.”*

New technologies are reshaping markets and industries around the world. Artificial intelligence (AI), virtual reality (VR), augmented reality (AR), Internet of Things (IoT), machine learning, robotics, autonomous vehicles, big data analytics, blockchain technology etc. are the range of new emerging innovations that are opening more opportunities for people around the world.

Today, virtual reality (VR) technology is used in video games. Tourism industry could be impacted by VR in the case that people would prefer to experience new and exotic locations

without leaving the comfort of their own home instead of physically to go to that location and have on-site experience. Therefore, tourism must be smart and balance the potential and threats of VR destination experiences versus real on-site location visit.

In other hand augmented reality (AR) through holograms and/or mobile apps that add virtual elements to a real-life situation provides completely new experience on-site/location. On-site, via virtual interactions with historical figures, some piece of a rock or of the wall in one castle can take tourist in the completely new dimension of experience without need of any equipment. At the same time the full-scale replica of a castle/cave/boat etc. can be made. Usage of augmented reality (AR) and the latest digital technologies helps protect fragile archaeological finds.

For virtual reality (VR) technology every tourist has to have VR glasses while for augmented reality (AR) technology there is no need for any equipment and that makes AR more acceptable and hygienic in its usage.

5 CREATING ENHANCED PERSONALIZED TOURIST EXPERIENCE

From the above written, we can conclude that in all four proposed tourist experience phases, advanced information technology can significantly enhance the tourism experience. In this paper, we will focus on the visit phase and explain one possible approach/example how personal tourist experience can be enhanced with the tourist personal interaction. This is implemented using advanced technologies like 3D projections, artificial intelligence, augmented and mixed reality, IoT, computer vision etc.

Our example describes the process of enhancing European Medieval Castle Cultural/Tourist Tour.

5.1 EUROPEAN MEDIEVAL CASTLE (MUSEUM) CULTURE/TOURIST TOUR

In this imaginary scenario, personalized tourist experience starts with the process of buying tickets for visiting the venue.

5.1.1 EXISTING TOURIST EXPERIENCE

Tourist group coming from Korea, family of four (mother, father and two children) approach the ticketing kiosk/station to buy tickets. They would like to use Korean language for

communication, but there are only 4 European languages available. They are very conscious about the hygiene and use wet paper towels to wipe and clean touch screen that is used for interaction with the ticketing system user interface. They want to buy four tickets and they realize that there is discounted family ticket option, but they missed the opportunity to take advantage of the additional discount for children under 10. Since both children are younger than 10 years, they would like to have a guided tour in Korean, but there is no human guide who speaks Korean available. Tickets are printed on the paper and validated by cutting the part of the ticket by person at the museum entry door.

Museum has interesting artifacts, but the history of that European Medieval Castle is not well known to the visitors. Therefore, tourists can't understand the story behind the exhibit. The tour starts to be boring for the young children and it's a challenge for their parents to keep them interested. Additionally, since the museum implements strict no-touching and no-photography policies, it's hard for parents to stop young, bored children not to break any of the artifacts presented in the museum. Consequently, they end up with no or little "stolen" memories in the form of bad photographs and very little to remember so motivation to visit the location again is low or non-existing.

5.1.2 REALIZATION OF ENHANCED PERSONALIZED TOURIST EXPERIENCE

In order to provide enhanced personalized tourist experience advanced IT technology could be used.

A family of four, mother, father and two children come to the automatic ticketing system to buy tickets. Because so many people are using ticketing system, tourist can use non-touch user interface that is managed by using simple hand gestures that are detected by the 3D sensor located at the top of ticketing system display. By waving with their credit card or mobile phone near the NFC payment terminal, the system automatically detects that credit card has been issued by Korean bank and offers to change language of user interface to Korean language/letters, which they accept. The system doesn't natively support the Korean language, but rather use computer generated language translation from the default English version. Meanwhile, the same 3D sensor integrated into the display of ticketing system (kiosk) determines gender and age group of all family members and finds out that children are under 10 years old and that parents are between 35 & 40 years old. Based on that, ticketing system automatically offers family discount and an additional discount for children younger than 10 years old.

After tickets are purchased, they are electronically issued as an e-mail that contains attachment that represent electronic ticket ready to be added to the smartphone electronic wallet, in order to provide ecologically compliant solution.

There is no person at the museum door, but the robot dressed as medieval historical soldier guarding the castle main door, holding a spear with the 2-blade axe in the hand. The spear represents an entrance ramp and a robot is lowering it to allow or block the passage. Cameras placed in robot's eyes are used for getting biometric "footprint" of persons at the entrance and this information is used to validate their electronically issued tickets and authorize their access to the venue.

When a family enters the castle, they first see a patina-framed mirror. When they approach the mirror, a young witch character appears in it and starts speaking Korean:

"Do you know that, in medieval times, families had more than 20 members representing five or six generations? Your quest is to investigate the castle and find out for hidden treasures that are used in everyday life of family. Each of you has different task, depending of your age. If you succeed in this quest, you will be awarded!".

Above represents a "Scavenger hunt", a type of game with prepared list of specific items which the participants seek to gather to complete all the items in the list. Participants work in small teams or as individuals.

The rest of the story continues to be told by other virtual characters, implemented as 2D or 3D projected images/avatars of actors dressed in the medieval fashion. Real historical artifacts are "stage" where these virtual characters are playing different roles according to multiple scenarios and personalities implemented with artificial intelligence (AI), similar to bots. That introduces a possibility to implement many variations in story telling scenarios which makes every visit unique tourist experience. Enhanced personalized tourist experience is created from decisions made by tourists themselves, but it is also influenced by the "free will"/personalities of virtual characters.

Outside light, temperature and wind sensors (implemented as IoT) are used to create a different context of each visit. For example, if it's cold and the snow is falling, story will branch to the version where lighting the (virtual) fire is one of the tasks for the tourist to execute.

IT enhanced replicas of artifacts are used to create interactive/tangible experience. They are placed along with real historic artifacts (not allowed to be touched) and virtual objects simulating touching by using augmented/mixed reality. One example of IT enhanced replica is

a “magic magnifying glass” that “reveals” hidden text and graphics by using special color management techniques to produce hidden images^[4] that are used in Scavenger hunt.

During the visit, tourists are creating their own unique memorabilia that are composed using augmented and mixed reality and recorded as 2D or 3D videos.

If the same tourist visit the castle again, his/hers personal experience will be different, as it is influenced by many factors, like age and type of the tourist group (family, school group of teenagers, student group of young people etc.). Personalized user experience is also influenced by the current castle/museum exhibit setup, story/theme that museum custos want to present, etc.

6 CONCLUSION

To describe/structure how advanced IT technologies can enhance personalized tourist experience, we propose a new four-phase representation of the tourism experience: **marketing, planning, visiting and memory preservation phases.**

During the **marketing phase**, advances IT solutions are used to improve the general image and create positive sentiments, usually targeting wider areas like cities or even entire countries. Individual offerings also intensely participate in this phase while trying to improve their visibility and differentiate themselves from other similar offerings.

Planning phase results in a detailed daily plan together with all other useful information that can be made available on the mobile device that a tourist will take with him.

In the **visiting phase**, advanced IT solutions are aiming the individual targets (museums, theaters, sport venues, adventure tours, amusements parks etc.) and serve three main goals: **providing clear guidance and instructions** for visiting, **creating enhanced interactive experience** and **generating appropriate personalized data** to be used in the memory preservation phase.

Memory preservation phase starts simultaneously with the previous, visiting phase, and continues after the visit has been completed. This phase has two main goals: **collecting digital memorabilia** and **organizing individual digital artifacts** into comprehensive “memory sets”.

Depending on the specific tourist experience phase, different IT technologies can be applied to create advanced and rich personal experiences. All of them will have to involve a lot of data

but clearly, the visual component (the way the underlying data is represented) is the key to success. There are number of challenges of using advanced IT technologies, starting with potential threat to visiting places (like using VR) and need for special devices. On the other hand, using technologies like AR/MR can enhance on-site experience and often doesn't require special devices / smartphones or tablets can be used.

Generally, there are several main categories of usage of advanced IT technologies: **Strategic and analytical tools, marketing and education, booking platforms, personal interaction.**

Personal interaction category promises the richest contents and creates long-lasting impression on tourists but also requires the most preparations for success. This is where imagination can really create very advanced solutions that are highly customized for a specific location.

This paper also presented an example on how to create enhanced personalized tourist experience with advanced IT technologies with emphasis on personal interaction in visiting phase. Key technologies used are bots, IoT, various multi-media and 2D/3D projection devices, stereoscopic cameras and elements of artificial intelligence like robotics and virtual, mixed and augmented reality implementations.

7 REFERENCES

- [1] Park, S.; Santos, C.A.; (2017) **Exploring the Tourist Experience: A Sequential Approach**, Journal of Travel Research, Volume: 56 issue: 1, (January 1, 2017), pp. 16-27, Available at (September 9, 2019): <https://journals.sagepub.com/doi/abs/10.1177/0047287515624017?journalCode=jtrb>
- [2] Neuhofer, B.; (2016) **An Exploration of the Technology Enhanced Tourist Experience**. Doctoral Dissertation Summary, European Journal of Tourism Research, 12: pp. 220-223, Available at (Sept 9, 2019): <https://core.ac.uk/download/pdf/42143073.pdf>
https://eprints.bournemouth.ac.uk/22032/1/Neuhofer-Rainoldi%2CBarbara_PhD_2014.pdf
- [3] Copeland, B.J. (2019), Artificial Intelligence, **Encyclopedia Britannica**, Available at (September 9, 2019): <https://www.britannica.com/technology/artificial-intelligence>
- [4] Pap, K.; Žiljak, I.; Žiljak-Vujić, J.; (2008) **Process color management for producing double images**, Annual 2008 of the Croatian Academy of Engineering, Volume 1, pp. 395-410, Zagreb, Croatia, <https://www.bib.irb.hr/422612?&rad=422612>