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Examining the Impact of the Internet of Things Tourism Industry in Vietnam

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Abstract. Internet of Things (IoT) is one of the outstanding achievements of the 4.0 technology revolution. The application of this technology is being used by many industries to improve work efficiency and save costs during operation. The Vietnamese tourism industry is currently gradually applying IoT in its operations, especially after the Covid-19 pandemic. Therefore, this article aims to provide a document to assess the impacts and trends in tourism when applying IoT. This technology helps to thoroughly solve the diverse experiences of the tourism industry in Vietnam. It acts as a thread to sew the pieces of information together to provide tourists with complete and detailed information

Keywords: IoT, Smart Tourism, Tourism Experience.

1. Introduction

Nowadays, the development of 4.0 technology has seen the emergence of many modern information technology applications such as Artificial Intelligence (AI), Augmented Reality (AR), Virtual Reality (VR), Internet of Things (IoT). Everyday computing devices with smart technology that operate when connected to the internet are called IoT. This technology has many powerful applications that leverage data to improve or provide better services in all areas of life. Currently, the trend of applying IoT in identifying possible disruptions in the hotel and tourism industry is increasing. In which the complex interaction of this industry with a number of stakeholders in the industry, or with other service providers supporting each other to bring visitors the best experience. It includes local population, food and beverage, accommodation, transportation, local government, attractions, etc., showing strong connections between art, religion, crafts, local culture, commerce and more.

According to Vanolo (2014) the location of people is recognized by mobile devices through smartphones, which has changed the overall perception of human space, and provided advice or suggestions and how to consume what when visiting the destination. Perera et al. (2015) argue that IoT with a smart home capability, objects can be connected through the empowerment of IoT and it does not stop there but can be smart wearables and smart cities.

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The integration of complex systems with the Internet is currently heterogeneous, examples include sensors, wireless smart devices and actuators (Li et al., 2015).

The expansion of virtual boundaries from such complex systems has expanded space and time, virtual components as well as expanding virtual boundaries with physical entities and virtual components. From here we can see that the Vietnamese tourism industry will have many new opportunities when applying IoT in the future. Relevant tourist information of destinations is easily accessible when tourists need it. This information brings new opportunities for the tourism industry when they are more interactive and more easily accessed, integrating a lot of information known through content marketing, wearable devices and big data, social media. The data can be interacted with by users and can be shared as a transformative information from knowledge production to knowledge exchange, or real experiences of tourists. Tourists search for experiences or travel recommendations from many other people for the same tourist destination through IoT. Companies in managing tourist destinations can more easily refine, edit or add prominent images of the destination to attract tourists as well as increase the number of visits of tourists at the destination. Destinations will become spaces that are closely monitored with blockchain technology, IoT and Big Data on tourist behavior, visits and shopping patterns within each attraction, creating monetary benefits output and time spent. If IoT is applied in the tourism industry in Vietnam will have a strong breakthrough in attracting tourists to visit and stay in Vietnam. It contributes to promoting the image of Vietnam strongly and widely in the minds of international and domestic tourists.

2. Background Theory

2.1. Internet of Things (IoT)

The definition cited by the International Telecommunication Union ITU in their Recommendation on Functional Framework and Architecture "IoT can be viewed as a global infrastructure for the information society, enabling advanced services by connecting things (physical and virtual) based on existing and emerging interoperable information and communication technologies (ICTs)." (Internet of Things Overview, 2012).

According to Nunberg (2012) the new IT field is a new paradigm shift called the Internet of Things. The term "Internet of Things" or IoT is made up of two words, i.e. the first word is "Internet" and the second word is "Things". The Internet is a global system of interconnected computer networks using the standard Internet protocol suite (TCP/IP) to serve billions of users worldwide. This is a network of networks consisting of millions of private, academic, public, government and business networks, ranging from global to local with many electronic network technologies linked together through form Optics and wireless networks.

There are two ways to differentiate IoT based on the purpose of use in Business or Industry and consumers, it only differs from each other in the connected devices. In business, the main activities of IoT are remote supply chain, equipment management, production flow monitoring, building management, healthcare, alert-based maintenance, and more. For consumers, IoT is mostly applied in smart homes, smart wearables, home security, personal health care, remote wireless devices, personal asset tracking. IoT brings many common benefits, which can be said to be data analysis for decision making or the convenience it brings in the future (Verma et al., 2021).

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An easy-to-understand example to illustrate IoT from everyday life is a TV recording device, you can change different spaces but only need to source at a single point (Aloi et al., 2017). And according to Zhou et al. (20018), the concept of IoT is similar to the example given, which is a control in the environment around electrical devices. We seem to be influenced by a wonderful technology from IoT, in our own daily lives, which is evaluated from our behavior through our response to those behaviors (Rose, 2014). All are controlled by smartphones to help us get the most convenience from life, remote control devices, smart home appliances to the safest means of supply and the shortest route (Brown & Haslett, 2018).

2.2. The Internet of Things for Tourism

With the prevalence of human-centered sensing in today's technology, data from IoT has three appropriate types: (1) Personal sensors, (2) Public sensors, (3) Social sensors (Campbell et al., 2008). According to Wu (2017), a new form of tourism called smart tourism through the application of IoT, big data, cloud computing, smart devices and artificial intelligence in administrative monitoring, tourism experiences and industrial development.

While personal sensors "focus on personal monitoring and storage" of individuals; social sensors are when "information is shared within social groups and special interest groups"; and public sensors occur when "data is shared with everyone for the greater public good (such as entertainment or community action)" (Wise and Heidari, 2019). There will be 26 billion devices predicted by Gartner to be IoT connected by 2020 (Tossell 2015), all major travel and hotel companies are aware of the huge opportunities and importance of the technology that it brings to modern businesses.

The travel experience is improved thanks to contributions from categories that form a network that collects a lot of important information. Personal sensors are monitored from daily activities to food preferences, IoT recognizes the differences from those individuals to provide appropriate advice for personal preferences as well as nearby offers for consumption or sightseeing and shopping. IoT can provide some information at the tourist destination such as: Favorite restaurants, dishes to try, the nearest suitable tourist attractions or the demographics of a historical figure or even tourists. Sensor devices that record personal activities are subject to data sharing, privacy settings, and ethical constraints, including for wireless sensor networks (e.g., Alduais et al., 2017), modern wearables (Liang et al., 2017), and connected cars (e.g., al-Khateeb et al., 2018).

A smart city with mobile crowd sensing can demonstrate safety, facilitate easy mobility, and achieve green urban environments (Pouryazdan et al., 2016). The popularity of smart mobile devices today has contributed to the widespread application of IoT in life, information about events or festivals is disseminated to tourists, helping tourists to interact or give feedback on necessary information to other tourists. Furthermore, IoT can also provide users with weather information, shortest travel time to their destination, and an estimate of the entire day. Noise and air pollution levels can be reported through environmental sensors. Here, crowd sourcing information can inform people about whether to find alternative routes, the best times to visit attractions or restaurants, how to avoid unpleasant surprises when traveling, where to park, and what public transport solutions are best. The Internet has long attracted tourists and enhanced the marketing of destinations, and an online presence is now available to all

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destinations ((Soteriades, 2012). Today's competition in the tourism industry requires that tourists find information relevant to their trip in a reliable, efficient, and fast way. Interacting with tourists through smart IoT tourism systems allows them to consume and engage together in a more immersive way (Gretzel, 2011). Hotspots or pathways can be created through geographically informed points of interest, guided by local business tactics to engage consumers and gain insights (Hospers, 2010). These interests and insights are then reinforced and supported by users, user-generated and/or user-led, more traditional destination planning and eliminating forms of marketing. (Cacho et al., 2016).

3. Methods

The study conducted a systematic review of relevant research topics and reviewed articles published in prestigious journals with high academic rankings. According to Justicia De La Torre et al. (2018), researchers are allowed to mine research texts to effectively evaluate the collected data and connect the common arguments of the documents. Therefore, the text mining approach was also used in parallel with the bibliographic review to take this in-depth review to an advanced level.

The authors searched for articles based on the keywords "Internet of Thing" or "IoT" to collect relevant documents more easily, including the Scopus and Springer indexes, and a number of other journals, selecting 236 articles. In addition, the search also included the keywords "smart travel", "IoT hotel", "tourist" to eliminate articles unrelated to the tourism industry, leaving 157 articles. Then, the authors manually selected 31 articles for text mining based on the impact factor of the journal in the year.

4. Impacts and new trends for Vietnam's tourism industry when applying IoT

4.1. Impacts

The rapid digitalization of IoT to machines or physical things in the form of smart connected devices is significantly affecting the services provided, business models and expectations of tourists. Customer experience is significantly improved as the tourism industry can tap into more and more IoT- connected data. IoT can be widely used to promote tourism due to the development of information technology, (e.g., information collection, ticket management, security monitoring, etc.) (Babu & Subramoniam, 2016).

According to Dave (2018), there are eight ways in which the travel or tourism industry can benefit from IoT: real-time information, personalization, streamlined operations, in-flight experience, automation, customer service, maintenance, and travel experience. There is growing evidence of technological change in tourism called "smart tourism". Therefore, the implementation of IoT is of great significance for smart tourism (Gretzel et al. 2015). IoT devices can be found in modern hotel phonfs. It is also used to integrate car rental or room service services, support hotel bookings and travel services through smartphones or a central application. It can integrate cooling and heating systems in hotel complexes and much more. There are smartphone apps where customers can create custom orders, pay and browse menus for their food over their phone.

The process of collecting data is actively and accurately resolved, moving seamlessly, personalization is tightly controlled, smart solutions are given based on collected data are given quickly, clearly defining sustainable development goals, connecting, maintaining, analyzing and repairing data through real time for users, and finally connecting stakeholders together including tourists. According to Wyman (2015), old data will no longer be data to help make estimates and forecasts but will be able to make a decision quickly thanks to real time. This will

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help service providers to satisfy customers by improving efficiency and user experience, services will be directly evaluated and easily monitored. This will provide higher standards of flexibility, high performance and efficient services through effective enforcement of regulations and reduced costs; improved trend analysis and predictive planning based on user-empowered forecasting in a transparent environment (Brous and Janssen, 2015).

IoT is a smart resource and energy saving tool that is good for all kinds of products and businesses and for consumer convenience. The volumes of data that need to be collected come in many different shapes but the data is unique and that is the main drawback, integrating and analyzing into business meaning at each stage of policy and standards requires a lot of business adjustment when there is no development to be able to violate at all layers (Process, Information, Communication and Device Functions (Ganguli and Friedman, 2017).

In addition, according to Pate and Adegbija (2018), security violations and data security for users when attacked by cyber attacks are negative impacts of IoT. Regulations and technological challenges in data sharing (Kaur and Kaur, 2016) and interoperability, cost and collection, harsh uncontrolled environments, replacement of equipment if any, over-reliance on sensors, self-maintenance of sensors (Evans, 2011) are also considered negative impacts. Furthermore, negative impacts are also seen in the management of data volumes, lack of adequate knowledge, data security, data authenticity (Brous and Janssen, 2015). The transition from current travel habits will require a well-thought-out change management process that does not just ruin the travel experience by training tourists in IT tools and technologies (Wyman, 2015). This revolution requires a complete change in the supply chain and user adaptation, which seems to be possible in smart cities, although the improvements are visible and effective but cannot be realized unless all cities and rural areas are able to name themselves under the hype name of smart cities (Wu, 2017).

4.2. New Trends for Vietnam's Tourism Industry

4.2.1. Tourist Experience Capabilities

Due to the relevance of tourism economic activities, there is a need to use the technological infrastructure of Smart City and smart strategies to create Smart Tourism Destination as a new tool, field of research and new solutions and tools (Buhalis and Amaranggana, 2013). In Smart Tourism Destination is a field where different technologies can be used including aspects depending on it.

Smart Tourism brings together the implementations and all the tools to interact with the physical environment such as AR, VR and tour guides among others. In addition, the technology support tool combined with the e-tourism cluster can be used after, during and before the trip almost as a planning tool (booking restaurant accommodation, booking hotel rooms, buying tickets for attractions, etc. (Gretzel et al., 2015). Smartphones have impacted people's lives, considered as a useful device for our daily life, and the so-called mobile tourism emerged from here. This concept summarizes the current tourism situation, where tourists do everything with their Smartphones, for example, booking and finding information about the places related to the heritage visited (Chen et al., 2016).

Based on the hashtags, the combination of technology with Gen Z as a tourist greatly affects the experience at the tourist destination. It starts to provide one of the exclusive and personalized experiences, eliminating the travel packages and this is considered is one of the marketing tools of travel companies. This generation, the new places they want to visit, short-term citizens they want to go to places where they feel at home and where they can live once-in-a-lifetime experiences (Gomez-Oliva et al., 2019).

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4.2.2. IoT Hotels

Rooms are predicted to be maintained, repaired and personalized, the customer experience will be enhanced through IoT by the Electronic Key Card sent by the accommodation provider to the customer's smartphone, which allows the customer to save their valuable time from accessing the room directly without wasting time at the reception (Verma et al., 2021).

Smart hotels today are adopting IoT which has attracted a lot of attention working on a proprietary IoT solution (Amer and Alqhtani, 2019; Ting and Ting, 2017). Moreover, IoT solutions provided by the company starting for the hotel industry can be taken as a typical example of Interact-lighting, moreover, hotel lighting systems have recently been applying IoT solutions to help customers adjust according to their preferences and save costs for the business.

Guests can be notified of intrusion through a system that detects the status of windows and doors and will notify guests if something is not as expected to take necessary actions. The security of the hotel and the safety of guests will be a reason for customers to consider choosing and saving costs. The health pattern and profile of guests are monitored through a system of sensors set up and in case of emergencies, guests can be notified to be taken to the hospital. To keep guests safe everywhere, at all times in the hotel, the important feature that needs more attention and investment is security. IoT with smart video can monitor suspicious behavior in the footage of security cameras or surveillance and can notify and capture the possibility of theft or intrusion (Verma and Shukla, 2019)

4.2.3. IoT and Airport

The potential of IoT for airports and aviation is affirmed by the Airports Council International (ACI) through the exchange of data and operational improvements between stakeholders. Furthermore, stakeholders sharing data will enable them to make better decisions leading to better customer service when checking passengers, managing checkpoints and managing identities by processing real-time on the lanes and for border and security agencies. ("IoT - crucial to a smart airport," 2019). New opportunities are opened up by applying this technology at low cost to the air transport industry and are ready to transform many new techniques such as improving connectivity with aircraft and tracking baggage, etc. are available globally and are also easy to deploy. ("IoT connectivity - new solutions needed," 2019).

In time, the remote access of aircraft is the beginning of advanced aircraft management and the trend of connectivity with the help of higher satellite capacity. This facility helps passengers at the airport to reduce the time during check-in by transmitting information from the flight to the passenger and makes the airport operations smoother through virtual walls and facial recognition to ensure physical security. Acute personalization, seamless journeys repair and maintenance are some of the initial rewards for the industry (Ordóñez et al., 2022).

Immigration, queue management, passenger flow, etc. are analyzed leading to increased airport operational efficiency, innovative and safe airports are always the top priority for passenger convenience (Qader et al., 2023). Through fingerprint, voice facial, palm and iris recognition are the biometrics that can be deployed and other methods and occupy a certain percentage of the market share. Among the above mentioned biometrics, fingerprint is the most popular, followed by facial recognition and scanning worldwide. Voice, palm and other biometric features still occupy 10% to 15% respectively, limiting forgery, allowing for accuracy, cost savings and hygiene (Thakkar, 2017).

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4.2.4. IoT and Destinations

Tourism has been changing with technology for many years now and has shown innovations in its processes and many advances in its operations. Transforming tourism into smart tourism is another technology trend of IoT and the core of the transformation of the tourism industry is IoT with the help of artificial intelligence, big data, mobile communications, cloud computing and blockchain linked to enhance the tourist experience (Wu, 2017).

According to Wang et al. (2013), to establish Smart Tourism Destination and IoT, there are three important forms of ICT mentioned. In terms of information provision and analysis as well as automation and control can be supported by IoT in smart destinations (Chui et al. 2010). For example, tourism service providers track consumer behavior and location of tourists through the use of embedded chips in entrance tickets that enable location-based advertising (Lin 2011). In terms of control and automation, the system can control the number of visitors at specific tourist sites by using a variety of sensors related to the capacity of each site (Mingjun et al. 2012).

According to Ordóñez et al. (2022), the focus is on the development of which tourists and the development of areas by raising awareness of nature and the environment as well as the attractiveness for both tourists and locals. IoT applications supporting destinations are given as follows:

- UAV, drone or doren-based imagery can be used to monitor the impact of tourists in the area. Time series images of erosion created by tourists can reveal newly created pathways.
- Video and acoustic sensors on sensitive natural areas can update visitors and provide detailed information as well as the scientific community about the biodiversity and natural values of the area. AR or VR mode will let tourists experience interesting destinations, such as famous attractions in Vietnam, such as Hoi An ancient town, HCMC theater, Vietnam history museum, visitors can enjoy the experience without having to go there. This is to reduce the pressure related to tourism on the environment.
- New value for tourists can be created from smart IoT solutions related to the conservation of fragile environments and nature at the global and local levels. Based on weather data measurements such as temperature, wind, UV intensity and humidity, recommendations on clothing and personal protection can be made

5. Conclusion

Vietnam's tourism industry is gradually recovering after the covid 19 pandemic, and is gradually revolving around the demands of tourists and modern or smart technology is an extremely important tool in meeting those demands effectively. IoT technology is affecting many aspects of the tourism industry and tourists that are developing in the world in general and in Vietnam in particular. With its flexibility and mobility in all processes of accommodation and travel experiences. This industry in Vietnam is gradually making outstanding developments in gradually applying the technical technologies of the 4.0 revolution, especially IoT, to help all processes be completed in the best way. Tourists are considered the final experiencers or end consumers or guests in different regions have begun to expect services that are standardized and positioned in such an advanced way of IoT.

The tourism industry in Vietnam will develop faster when applying IoT. This is one of the big and strong steps forward of the tourism industry worldwide. The scope of technology, especially IoT, is gradually shifting more to industries such as hotels and tourism to facilitate

service provision and business feasibility. In the future, the tourism industry in Vietnam will open a new page, carrying new strategies towards integrating advanced technologies in the operation and development of the industry. IoT will revolutionize the tourism industry in Vietnam and there is still much to develop. It will become easier when applying IoT, we can be more proactive in checking in and out of hotels, easier in finding suitable tourist destinations, etc. Therefore, investing in technology right now in the tourism industry is an urgent task, it helps connect the infrastructure of a country to act together in responding and improving the quality of tourism services in Vietnam

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