Role of Disruptive Technologies in realizing Virtual Tourism

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Abstract

With the advent of digital technology, disruptive innovation is a strategy that is being adopted both by the manufacturing as well as the service industry. Disruptive digital technology like smartphone technology, social media, internet, and mobile applications have led to Business to Business (B2B), Peer to Peer (P2P), and Business to Consumer (B2C) strategies promising shared economy for tourism destinations. Technological disruptions such as IoT, Artificial Intelligence and rich media like virtual and augmented reality, parallel reality have created smarter environments that transformed tourism in terms of its structure, processes, and practices. It is a relatively modern form of technology, introduced to the existing tourism market which enables service providers in creating a unique experience for their customers. Here the customers motivate others in order to reap the benefits of technology-driven product (Danneels, 2004). These technologies create entirely new products and services that are dramatically cheaper, better, and more convenient forcing change in the whole new competitive industrial workforce. Such innovations are because of continuous scientific discoveries for a more technology-driven competitive paradigm (Kostoff et.al. 2004). The emergence of such smart environments will redefine the tourism sector as customer experience solely prevails on varying levels of infrastructure, organization, and cultural constraints (Buhalis et.al. 2019). The paper tries to explore various disruptive technologies that could be used for promoting tourism in a destination, forcing stakeholders to rethink and reengineer their services in this competitive ever-changing world.

Keywords

Disruptive technology, Virtual tourism, Technology, IoT, AI, Block chain, Parallel Reality

1. Introduction

Since its inception Information and Communication Technologies (ICT) have been transforming and revolutionizing all forms of the product as well as the service industry. The travel industry, only second to the manufacturing industry, is under a high level of competition. Hence, it warrants technological interventions in order to satisfy the ever-increasing demands of customers with affordable pricing. The introduction of the internet and mobile-based technologies have evolved the industry by providing consumers with Virtual Reality, IoT, Artificial Intelligence, Robotics,

and the like (Adeyinka-Ojo, 2019). The tourist is the end consumer who is looking for a quality experience. Smart e-platforms are an essential component of the tourism industry wherein disruptive technologies changed relationships amongst the players in this domain (Vigila et.al., 2016). Earlier also, the tourism industry is known for offering services to its customers in an environment with rapidly evolving technology, ICT, and e-tourism thus integrating new technologies with strategic planning processes (Buhalis et.al., 2019). The paper critically reviews the technological advancements providing insights into the technology-based innovations in tourism like Virtual Reality (VR), Augmented Reality (AR), Internet of Things (IoT), Artificial Intelligence, and the like. According to DaSilva, technology alone cannot make changes but when combined with tourism could revolutionize the whole experience of travel for the tourists. The paper then continues to give an insight into the various types of technologies that could help in enhancing the tourist experience Post Covid19. If incorporated effectively, this could revolutionize the travel wherein the industry will be less dependent not only on the physical mobility of people but also carrying out business in the absence of staff while harnessing income.

2. Disruptive Technologies

The concept developed by Clayton Christensen could be considered as a business model innovation. He advocated that disruptive technologies will transform the product or service into something which is more reliable and affordable to the larger population. In other words, here he introduced an alternative package that is simpler, smaller, and are more convenient (Guttentag & Smith, 2017). According to Buhalis, disruptive technologies have immediate implications on the service industry-leading to unprecedented impacts on the macro and micro levels.

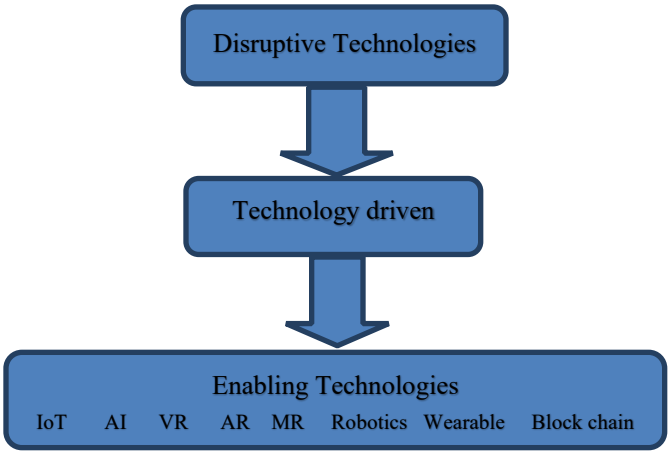

Fig1: Disruptive technologies to Technological Advancement (Adapted from Buhalis et.al., 2019)

Figure 1 indicates how disruptive technologies lead to enabling technologies using technology-driven tourism. The 5th generation mobile network though at its early stage will be a platform for collating large volumes of data providing a higher level of customer engagement which is expected to rise by 2020 (Buhali et.al., 2019).

Tourism industry stakeholders along with ancillaries are working relentlessly towards providing consumers with unique experiences which could be effectively disseminated through technology

inclusion. There are countries in the world with numerous and attractive sites which tourists could not visit. The technology could promote as well preserve heritage sites and help common tourists explore such destinations. According to Kaelber, tourism websites could be mainly divided into three forms: tourism online, online tourism, and technology-driven tourism. Thus, the paper mainly focuses on the impact of technology-driven tourism towards promoting tourism.

3. Technology-driven Tourism

Tourism online refers to sites hyperlinked for enhancing travel experiences such as how to get there, about the place, and the like. Online tourism refers to a person's memoirs etc. after visiting the site. It is a form of feedback that acts as a reference point for other tourists as well, who wishes to visit the site in the future.

Technology-driven tourism is used by some of the prominent hotel chains and airlines in order to enhance the visitor experience. However, it's imperative for the travel industry to create experiences using a technology-driven operating environment for those prospective visitors who are in home confinement and would like to visit.

4. The Way Forward

After recovering from Covid19, several revival strategies have been adopted by tourism industry as revival chances are more (Guttentag, 2010). In response to this, destination organizations have developed technology-driven entertainment facilities for tourists. Technology has been consistently evolving itself. It's no wonder that it has had an immense impact on the tourism industry as well. More and more hotels, resorts, travel agencies, airlines, and destinations are looking up to technology for building an excellent reputation and customer service amongst tourists.

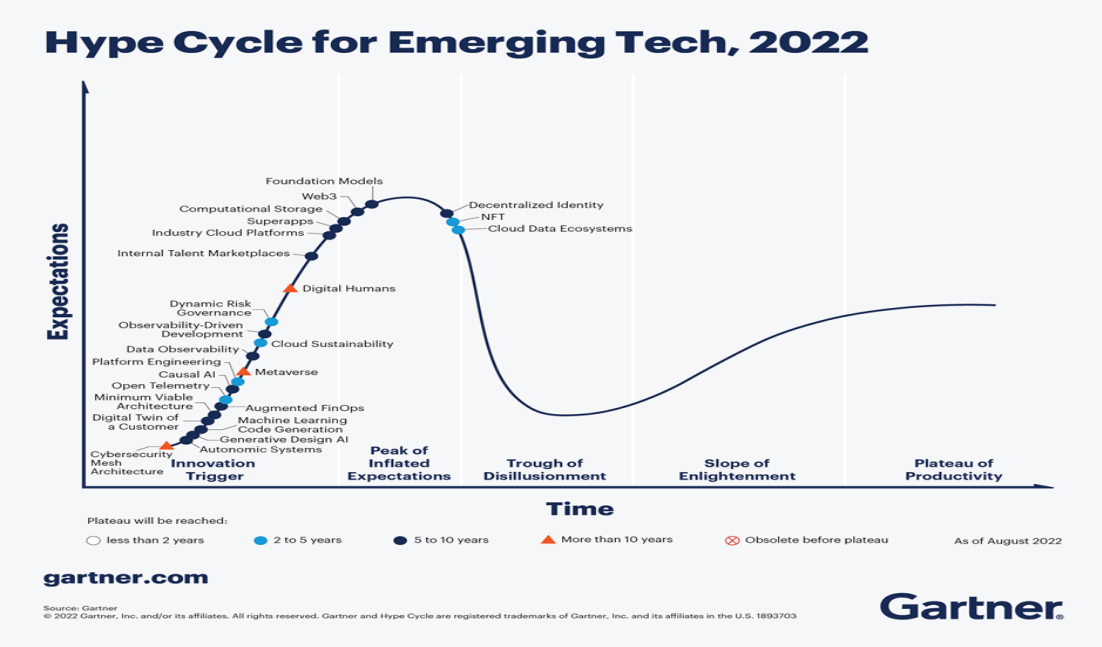

Fig 2: Hype Cycle for Emerging Technologies. 2022
Source:https://www.gartner.com/en/articles/what-s-new-in-the-2022-gartner-hype-cycle-for-emerging-technologies

Some of the existing technology-driven applications used by the tourism industry are broadly known as the Internet of Things (IoT) which includes Artificial Intelligence (AI), Block chain Technology, Robotics, Voice Control Technology, Facial Recognition, and so forth. IT departments must provide a repeatable, proven, scalable, and creative business core. These principles provide a solid foundation and core for IT to create business value. Trust not only necessitates security and dependability, but also repeatable and established working processes (Panetta, 2021a).

According to the above fig 2, Gartner identifies 25 must know emerging technologies which could be divided into three broad areas such as Immersive experiences, Accelerated Artificial Intelligence (AAI) automation and Optimize Technologist Delivery. Gartner in addition reiterates that such technologies are in its embryonic stage, but holds greater uncertainty as we don't know how it will evolve in the next two to ten years.

Technology-driven tourism is used by some of the prominent hotel chains and airlines in order to enhance the visitor experience. However, it's imperative for the travel industry to create experiences using a technology-driven operating environment for those prospective visitors who are in home confinement and would like to visit when the world opens up post Covid19. Hence, the paper tries to explore some of the innovative technologies vital for today's travel industry during this lockdown period.

4.1. Tourism Industry Development through Digitalization: A Strategic Approach

"The digitalization of procedures in the tourism sector" was coined as the definition of e-tourism (Buhalis and Foerste, 2015). There is potential for differentiation in the competitive market, and early adoption of AI could be regarded as a competitive advantage. From the consumer's perspective, AI and big data technologies can enable extreme customization, while from the supplier's perspective they can boost performance and profitability. (Samara et al., 2020). In the modern digital era, AI collaborates with human sentiments and intellect to provide customers with convenient online and offline interactions. Increased efficiency, productivity, and a better knowledge of services are all benefits of this strategy. Computer technology also helps to advance a component, such as marketing, to improve the whole travel process. (Kazak et al., 2020).

The use of artificial intelligence in real life will grow more mature as the technology continues to advance. At the same time, artificial intelligence's application in modern tourism will be a new development trend for many years to come (Zhang & Sun, 2019). Back-of-house management is undergoing a transformation as new digital tools and management systems allow for more efficiency. The process of providing a personalized experience is progressively becoming automated by guest-facing, location-based services. Furthermore, internet and mobile apps are becoming increasingly engaging, resulting in increased consumer loyalty (Worimegbe et al., 2020).

This would lead to small sectors shifting their focus from traditional bookings more tailored offers through digital mechanisms (Kumar & Shekhar, 2020). The worldwide travel technology industry is anticipated to increase by more than 9% between 2010 and 2023. New forms of employment will be generated as a result of AI in the travel and tourist business. The industrial environment and procedures used by tourist firms can be shaped by technological considerations (Samala et al., 2020).

4.1.1. Internet of Things (IoT)

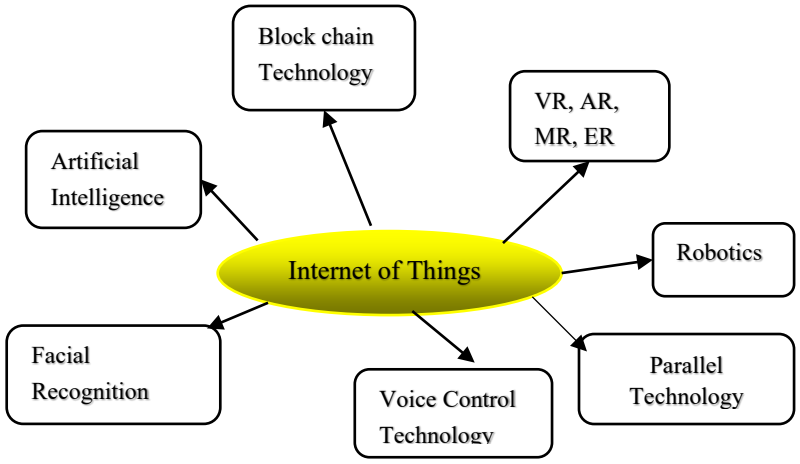

Fig 3: Various technologies under IoT

The Internet of Things (IoT) is a term used to describe a system of electronic equipment that is linked to the internet. It is a booming technology that has the potential to change industries including transportation and hospitality. IoT consists of sensing, gadgets, applications, and other items that work together in a symbiotic connection to make a person's life more pleasant, simpler, and suitable (SemiColonWeb, 2020). This could range from smart energy meters to driverless cars (www.revfine.com). Tourism industry has been utilizing IoT in the form of personalization and the like. In addition, improving health care systems has become mandatory for all countries. IoT could help countries track and have greater control over accessing information on tourists which is the need of the hour. Some examples that are already in place are enumerated below in Table 1(Choudhary, 2020). With increasing realization of new levels of customer realizations, owners and operators are utilizing IoT to give new levels of customer care including hotels, restaurants and conference halls in cutting expenses (7 Cutting-Edge Use Cases of IoT in Hospitality, 2021).

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Table 1: IoT devices used by various countries

Country	Devices	IoT functions
China	Connected Thermometers	Real-time monitoring of changes in body temperature. Information is transmitted through Bluetooth to the nurse station for continuous monitoring even in the absence of the Internet.
Hongkong	Electronic tracker wristbands	To alert authorities who do not comply with quarantine rules

China	CloudMinds	AI-enabled bands provide a constant temperature recording facility including vital signs like breathing, heart rate, etc which could be used by local people anywhere anytime.
Vancouver	Wada Quick Touch	Battery operated, automatically getting connected to LTE-M network, alerts authorities regularly where cleaning is required.

IoT provides a personalized multi-sensory hospitality experience by connecting them to all five senses, such as scent, voice, eyesight, touch and hearing, influencing the visitor's experiences (Pelet et.al., 2021). According to Pelet, female's senses are much higher than their male counterparts.

Table 2: IoT devices used by various countries during Covid19

Internet of Things Technologies	Features
Wearable tech (Smart glasses)	To identify and recognize a repeated client facial structure (when they arrived at the hotel) and provide information on their likes and interests, allowing them to make tailored offers.
Integrated minibars	It informs when a commodity is picked up and has to be refilled; smart refrigerators that order online to avoid running out of product supply. This data will be used to arrange the client's choices in the minibar for subsequent visits.
Facilities management	That controls the use and upkeep like air conditioning, energy, and water-based on the client's priorities and occurrence (or absence) in the room where it should be enabled, allowing hotels to save money by eliminating unregulated use and satisfying guests by evolving to their choices
Mobile locks	It enables clients to access rooms instead of using keys by using an app on their phone that also sends an alert once the room is ready.
Smart meal tags	Hotels and restaurants can operate buffets wirelessly and show meal information in a more effective manner than with paper-based tags by implementing this new technology. The chef may more efficiently convey allergy details, nutrients, and the quality of his food, ingredients, and receipts by employing IoT-enabled smart meal tags.
DuotelCube	Adopted by Chineese hospitality sector, it enables guests to communicate with hotel employees via the box, it can handle room service, transactions, and even language understanding, reducing the need for face-to-face interaction.

Source:(Hosteltur, n.d.),(Yuksel et al., 2020)

The above table indicates the IoT devices used during Covid19. Some of the factors that leads to the adoption of IoT in various tourism sectors attributes to the commitment of top management towards digital preparedness (Infante-Moro et al., 2021).

Along with the facilities, numerous challenges are faced by tourism industry with the deployment of IoT. Some of the challenges could be high use of sensors, lack of correct network devices and cyber-attack including loss of data (The Internet of Things for the Hospitality Industry Build a secure foundation to leverage IoT business opportunities Solution Brief IoT in Hospitality, n.d.). With health and wellness being a constant concern for tourists, it will be mandatory for destinations and stakeholders to improve on hygiene and sanitation facilities as well.

4.1.1. Artificial Intelligence (AI): Artificial Intelligence (AI) not only allows effective dissemination of services thus eliminating human error but also performs the business task quickly, 24*7 (www.rvfine.com). It's a relatively recent technology used for processing Big Data ranging from analysis to problem-solving. Accordingly, deploying AI in the travel industry will potentially save time, increasing performance while reducing human error to a bare minimum. Increased use of Chatbot's, online conversation, and intelligent personalized online booking has diversified and enhanced the functioning of the industry.
Hence, an AI exposes a traveler to a big world of technology making his travel much simpler and more comfortable. Several start-ups are already in place incorporating AI-based travel solutions for tourists post Covid19.

Table 3: AI in various countries

Country	App	Functions
Tel Aviv	Aircules	Helps airlines reduce overload, provision of updating passengers along with a facility to rebook and refund process
Japan	Bespoke	A Chatbot where the Japanese government can ask the travelers about their health such as viral symptoms and the like in their language
China	Face++	Infrared cameras with computer technologies at airports and subway stations to track individuals with fever. It helps to detect the patients without close contact thus reducing the scope of contagion
Canada	Sitata	A mobile-based platform that provides travelers with pre-trip and safety health advice

4.1.2. Voice Control and Face Recognition Technology: This technology controls the devices and could be operated using smartphones, smart home hubs as well as personal computers. It uses IoT and AI and in the future could be used to even lock doors thus increasing the security of the tourists. Today destinations are promoting touch less travel. Voice control and face recognition technology could be a solution for it. It will direct tourists with the procedures in the airport which may also include regular sharing of health data in order to reduce the risk of spreading the disease.

4.1.3. Tele-robotics: Advancements in technology like Tele-robotics have enabled scientists to explore deep oceans, extract resources from dangerous mines and carry out high precision surgery sitting miles away in another continent in his or her home. Thus, tele-robots, tele-operators, and remotely operated vehicles are a class of machines that work remotely without a human presence on-site (Friz, 1998). Tele-presence could be utilized in the tourism industry as well to get better

results with minimum cost. They could be used in situations that are potentially a threat or not accessible. Moreover, the interactive behavior of visualization helps to measure the size, location, and orientation of the objects. This could also help destinations that promote dark tourism where disaster has actually occurred. Tele-garden, telemedicine, and Tour boat (Tele robotic tour guide) are some applications (Kahan, 2005). Remote user settings like a robotic arm fitted with sensors and camera will enable a tourist to have a remote experience of a museum, or a park in another country. Such technology driven tele-robots give tourists with a unique experience without leaving his or her immediate environment within an air conditioned room. Here the remote user sitting at the home commands the robots to perform a particular task. According to Carter, tele-robots have become popular in public especially for a differently abled tourists. The only requirement for a tourist is the high-speed internet, input and output devices in order to get a feel of accomplishing a task like scuba diving, rock climbing, trekking and the like (Friz, 1998). One such experiment has been successfully implemented by Singaporean engineer and entrepreneur, Koh Seng Choon through the concept of "Dignity Kitchen" developed under the influence of the movie "Avatar" (www.scmp.com/lifestyle/article/3160524). "Dignity Kitchen" is a social enterprise restaurant run by differently abled who work as remote customer service robots, through center operated "SAHK", thus providing employment opportunities to people, integrating them back to society. According to Koh, he wants to implement the same technology in airports, schools and the like along with a payment gateway as well so that the differently abled people get income while working from home.

4.1.4. Virtual Reality (VR): It is a computer-generated experience where tourist feels to be in another world (Merk, 2014). It recreates a real tourist destination into a 3D model in order to give an original feel to it. As done in Auschwitz tourism, 3D virtual gas chambers, crematoria, death factories, etc. called victims paths are recreated (Merk, 2015). Here a tourist goes through recreated experiences like gas chamber tours, to cite an example, wherein they experience what Jews had undergone. Obviously, a tourist can't have the same feeling even if he visits the destination. It runs into several episodes and using several forms of sound modulations including children crying so that the tourist gets a real-time experience of misery that they had undergone. This is one way of promoting dark tourism. The user requires a virtual reality headset along with a rigidly mounted camera in order to completely block the real world, bringing out a unique "sensescape" to the tourists. This could be combined with geo-information systems. It is particularly useful for tourists who are unable to navigate outside due to unprecedented reasons like weather, strike, lockdown, or even physical disabilities. This gives the opportunity for tourists to visit the "traumascapes" which are either not accessible, substantially altered, or do not exist. Here the cyber guides will take the tourist on a virtual tour wherein he will not be able to substantially differentiate between walking and browsing (Kaelber, 2007). Though virtual tourism gives a good experience, the major challenge it poses is the level of independence. It inhibits a tourist from free movement and has to sit in the same place throughout in order to have a virtual experience.

4.1.5. Smart Tourism Drones: A relatively new tactic used by tech-savvy tourism businesses is combining drones with virtual reality in order to create an interactive walkthrough of a destination. This application could be used by tourists to roam around remote areas (Merk et.al. 2015). It also helps tourism businesses to develop several videos that could trigger a visceral reaction in viewers. It utilizes immersive technologies, wherein a tourist wearing goggles could feel being on the top of a cliff which otherwise he or she cannot imagine. The idea behind is to promote client-software applications in order to enable real time video images and watch them locally. It is cheap, low-

stress, and environment-friendly form of tourism. But it also carries its share of problems like lag, collision. In addition, moderate wind may also affect the drones.

4.1.6. Augmented Reality (AR): With new generation mobile phones having co-located activities such as GPS and WiFi, these could be ideal iOS and android platforms for collaborative Augmented Reality, thus creating massive penetration into the world population (Brito, 2015). Unlike VR, AR is a digital technology that does not replace the original environment but augments it through overlaying digital components. It does not require heavy gadgets to experience a destination, instead requires a smartphone, tablets, and the like. It is not limited to tele-robotics but will enhance its functions. Augmented guides are another such application, which seeks, recovers, and pictures data as per the demands of tourists from various internet sources (Akram, 2017). Smart glasses and headsets will anyway enhance the visitor's experience. The problem with AR is the availability of internet services with high-speed connectivity. Still, in certain rural as well as urban locations, information meandering charges could be very high, making it quite unaffordable for young vacationers.

4.1.7. Mixed Reality (MR): This is a new and very recent form of technology wherein it creates a whole new environment. It merges the virtual and real-world and sets them as per the convenience of the tourist. It provides an advanced experience to its customers. In other words, an artificial environment is created wherein the virtual objects can interact with real objects in his or her home environment. It is more immersive and interactive than AR. A person need not sit in one place to experience the virtual environment, instead, he could move around his room using translucent glasses that will also enable the user to perfectly see his immediate surroundings. It gives a tourist completely immersive communication experiences without being blocked by the real world. One such example is a solo tour developed by Microsoft for exploring Rome and uncover the hidden secrets of Machu Pichu.

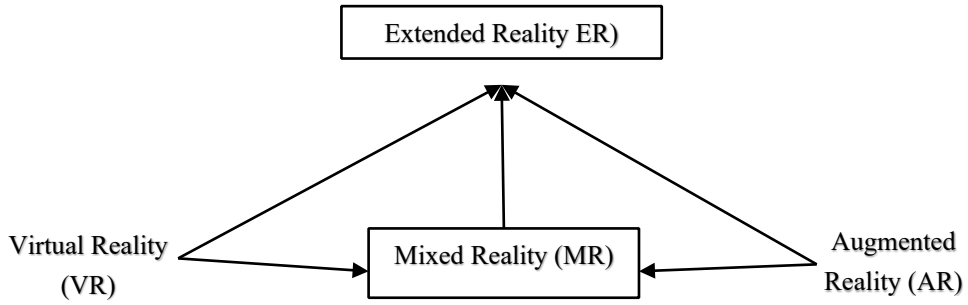

Figure 10: A combination of VR and AR is MR which then could be made ER

The application requires a Windows Mixed Reality-ready PC and immersive headset, or Microsoft HoloLens. With the help of a tour guide Mellisa, a tourist can trek as high as the Andes or venture into ancient Rome having real-time experience of the population living in those times called Travel Back in Time. Here the tourist can literally experience gladiator fighting from the perspective of the emperor. A tourist can actually walk into the room, turn around as there are no wires. Users head is the camera, along with body movements and sounds one feels as if it's coming from the location. Sounds are localized so as to give a more effective feel to the tourist, thus building in experiences through the holograms into the real world. It's an inspiration for people who want to bother on apps. With MR, the real key is the ability to navigate the physical space very comfortably

while at the same time occupying the immersive virtual space. The real disadvantage being that one can experience MR only through holographic devices.

5. Nanobots:

Nanotechnology robots, Nanorobots or nanobots are molecules with unique properties that are programmed to carry out a specific task (Nehemiah, 2014). Just like advanced nanotechnology has influenced every other industry so is tourism. People can reach various travel destinations located in different parts of the globe without actually travelling or spending money. According to Nehemiah, nanobots could be a step further from virtual reality technologies which could be an extended reality experience. Though at present this technology is imaginary, still it is expected to revolutionize the leisure and travel industry by 2040. These nanobots are self-guided devices and once ingested, it activates the visual and auditory neurons within the user's body. Whenever a user wishes to venture into virtual reality, the nanobots suppress the real world and stimulates the virtual arm and leg in a virtual simulated environment. The device is safe and the user need not use any goggles or Hololens to actually venture into this environment. This creates no harm to the body and can be removed anytime without any form of surgery as done today (Nehemiah, 2014). The device is still imaginary hence a lot of research will be required to actually implement it but has a promising future. The distribution of such smart devices will mean that tourism in the future could be promoted by even a 12-year-old child sitting in a remote area.

6. Parallel Technology

One of the most recent developments towards digital enclosure could be considered as Parallel Reality. "Digital Enclosure" is another name given to convenience, efficiency and access as the customers today are bombarded with relentlessly various interactive media (Andrejevic, 2022). One such platform has been developed at Detroit's Metropolitan Airport. The airport uses "Parallel Reality" in order to customize the tourist experience through smart cameras. The tourist is required to register his or her face. Once done he will be provided with a personal information of his flight and the directions he or she should take. This saves a tourist from a very trivial problem of identifying one's own flight amongst one thousand other flights as Detroit international airport happens to be one of the busiest airport in World.

7. Conclusion

The shock caused by Covid19 has been grueling in many countries. Post Covid19, industries throughout the world is more tech-savvy. Automatic check-in and check-outs, tourists locating their destination could be some of the innovations that will design the future travel industry. Apart from the technologies mentioned above, many like social robots, Quadcopters are being studied in order to understand their feasibility in the current tourism scenario. Full Immersion Virtual Reality (FIVR) another technology though at its infant stage, is being adopted by travel firms to improve the visitor experience. The aggressive implementation of such technologies by industry stakeholders indicates that technology change will be exponential in the 21st century in a way that, within 100 years it will record 20,000 years of progress. This will also improve the tourism economy as it could be a source of income too as tourism business revolves around user. In the future, innovations like multi-user interactivity along with sound integration could be according to Kaelber a few mouse clicks away. According to Nehemiah, it's a proven fact that the industry stakeholders who failed to change and update their business model as per the demands of tourists had to incur heavy losses. Innovative

technology adoptions like excursions to the moon proved quite affordable even for middle-class families enjoying vacations to lunar bases on a moon locally, giving tourists monetary advantage while reducing the cost of space travel. Technology is now being developed to bring in 4-dimensional interactive environments to improve the visitor experience. In future, technology will enable travel industry garner more income and business even during Lockdown or any other form of breakdown meaning it is meant to stay for all forms of tourism. Hence, it is important for the travel industry to incorporate these technologies in the current scenario in order to be at par with the competition as well as tourist expectations.

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