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New Technologies for Museums: Perspective Enhancing Visitors' Experience

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Abstract:- Museums have taken an initiative to embrace the new technologies for the visitors. Museum as a cultural institute reflects all changes occurring in cultural, political, economic and technological fields. Nowadays, as modern technologies bring major changes in the way we perceive space and time and open up new ways in understanding the world and all things, the museum is considered as a network of potential things, a kind of interactivity that use digital reality to create a connection between the museum curators and patrons. This paper aims to find out the usage of various technologies in museums. It also includes an analysis of different experiments and experiences in the new technology-based museums of Bangladesh and of abroad. A survey, content analysis and observations were included as methods of data collection and descriptive methods through different statistatical tools were used to data analysis in this study. This study shows that the digital technologies augment visitors experiences.

I. INTRODUCTION

Nowadays, people spend most of their time in front of the screen with Internet connectivity. Because of this, the museum professionals are facing challenges to get the attention of the visitor. It is high time to think about how to make museum exhibitions and collections more relevant and compete with the existing entertainment ways to catch the attention of the visitors. Museums acquire, conserve, research, communicate and exhibit the heritage of humanity and its environment for education, study, and enjoyment (Desvallées, A. and Mairesse, 2009). Museums should provide access to education, develops museum facilities, provides ways to entertainment, and presents the collection to the public (Vaz et al., 2018).

At present almost all institutions are focusing on non-formal education, so it is wise to try to meet the needs of the audience by adapting to modern technology. In this case, the use of innovative technology can be encouraged. In this context, an interview of Mr. Srinivasan, Chief Digital Officer of the New York City (until June 2016) Metropolitan Museum of Art, may be a good example. He said that now museums no longer have time to compete with each other; because omnipresent technology, such as video games, social media, etc., is reducing the number of visitors to the museum. Instead, every museum needs to find ways to embrace technologies and equipment, i.e., smartphones, tablets, smartwatches and other digital devices, to take advantage of them. If the use of these devices is ensured, the museum will be at the fingertips of the people wherever they are. When asked what is the biggest challenge for museums? He answered, it was not the Guggenheim Bilbao Museum in Spain; it was not a historical museum, rather Netflix, Candy Crush Game or Pokémon Go Game. Considering all this information, it is clear why interactive media is needed to display museum collections. Again, digital resources are worthless if they are not presented in a way that is understandable to the general public. The use of technology is required to present intangible resources to the public; Such as sound recording, songs, video images etc. In this way the flow of information can be created, which is considered as a digital replica.

The use of digital resources plays a beneficial role in the case of tangible samples. Through this, the visitors get a better idea about the collection, because it does not have to provide additional information but can be presented to the audience more interestingly and effectively. Even people with disabilities can be allowed to experience (feel) the exhibition using digital resources. However, it should be considered as a medium without thinking of being completely dependent on technology (McMullan, 2015; Olesen, 2016). The main theme of the museum should be how to provide the best incredible experience to the visitors through digital content.

Considering the above, it should be decided how the quality of display and exhibition can be improved by using any kind of new technologies in the museum. In this case, the article will mention the virtual museums, online resources, interactive kiosks, interactive projections, mobile applications, measures relating to interactive technologies taken for people with disabilities, etc., used in museums around the world

➢ *Research Need*

The remarkable technological growth has a great impact on different areas in the life we live and makes a positive impact and result. The museum sector is not far behind in case of using technologies. The use of various technologies is noticeable in different museums around the world. Technology is evolving every now and then, and people are getting used to it. If museums can't use new technology, they may lag behind in attracting the public. In this case, it is important to keep in mind that using the Internet or mobile devices or sensors-based installation or digital media, etc., to create a system suitable for visitors, through which the museum's purpose can easily be understood. Examples of interesting museum systems can be found in different countries of the world. Museums are generally regarded as cultural institutions. However, if the museum does not become the center of interest of a society with its collection, its acceptance will decrease day by day. If this happens, it will become a threat to the cultural heritage. For this purpose, several types of technologies used in different museums around the world have been discussed. The following questions have been answered in this research work:

a. What type(s) of technology can be considered suitable for a museum?
b. Has the use of technologies increased or decreased public interest?

II. LITERATURE REVIEW

The museum executives have shown interest in new technologies in exhibitions. They have used various devices to achieve their goals. Developed technologies like touch screen devices, PDAs; virtual galleries etc. are being used in exhibitions. Many researchers are now exploring how the devices can be designed to attract the attention of the visitor community and facilitate social interactions (Aoki et al., 2002).

Researchers have tried to study the interrelation between visitor behavior and learning in museums. It involves behavioral and cognitive science and strives to assess to effectiveness of exhibits in attracting visitors. It also tries to communicate information with them. This relies on three quantitative indicators: 'stopping power'- the number of person stopping in a gallery/ exhibit, 'dwell-time'- the average time a visitor spends in a gallery/ exhibit, and 'communication power'- the impact of a gallery/ exhibit in providing information to the visitors (SHETTEL, 2010).

There has been a concern about how modern devices and technologies, like information kiosks, touch screen devices, PDAs, mobile applications, Virtual Reality (VR) objects etc. can enhance the effectiveness of exhibits. Researchers tried to find out answers to some questions such as: Do exhibits equipped with kiosks attract more visitors? Do they spend more time in that exhibit? Do visitors use VR headsets? Do visitors use PDA to read a key label? Do visitors understand the message/key label? Do visitors interact with each other when using these devices and technologies? Do they seek help from museum executives? Technology-equipped gallery/ exhibit attracts more visitors and they spend significantly more time (Keene, 1998). Visitors also discuss with each other and engage in social interaction.

VR has greatly dominated the museum sector. It made easy for various visitors from different countries of the world to engage with the museum. It is mentioned that VR is creating a way for people to experience and perceive heritage (Shehade & Stylianou-Lambert, 2020). Augmented reality (AR) is another form of Virtual Reality (VR) (Azuma, 2014). It can intermingle the actual environment with the virtual one for real-time interaction. The implementation of AR/ VR can decrease the existing gap in the area of traditional museums which do not offer an interactive stage for museum visitors and artifacts. The museums set an option to count the number of visitors for AR/ VR, but not user reaction.

As we are living in the era of the Fourth Industrial Revolution, Artificial Intelligence (AI) plays a significant role in supporting and developing museum services. 50 years ago, the concept of AI would have been considered an alien technique. It was considered as content 'reserved' for science fiction movies. It is mentioned that, in a museum, new technologies such as AI or visual recognition are being regularly introduced (Giannini & Bowen, 2020). Thus, digital media enables museums to reach a larger and more diverse audience with the help of AI with less human intervention.

An interesting feature introduced by some museums is 'Chatbot'. It is a computer-generated program that tries to simulate the conversation of a human being via text or voice interactions. It uses machine learning and natural language processing. Chatbot can function as a guide to the museum and answer some simple questions asked by visitors. 'Even in their simplest forms, chatbots can be used to provide more information, something many museum visitors welcome' (Charr, 2020). The chatbot is a sophisticated way as visit planners (Schaffer et al., 2018).

It is clear that different technologies are being used in the museum since the beginning of the 20th century and it is not a new phenomenon. Virtual Museums, Virtual Reality, Augmented Reality, Artificial Intelligence, Chatbot, etc. have gained popularity among the museum authority and the audience.

➢ *Methods of Study*

This study used purposive sampling and conducted a short survey (face to face interview) on 60 respondents or visitors in September 2021 to May 2022. Among 60 respondents 45 were from colleage and university students who are most familiar to the digital technologies,10 were of young people from different professions and 5 were of aged visitors. This study is also based on content analysis and observations for data collections and

data analysis. To conduct this study some secondary sources such as books, journals, webresources etc. were used. To analyze the collected data insights from other articles were taken and inputs were given to understand the visitors experiences – whether the experiences increase or decrease.

III. FINDINGS AND DISCUSSION ON DIGITAL TECHNOLOGY

➢ *Digital Technologies used in Museum*

Different digital media or technologies are adapted in different museums around the world. Those technologies are as follows:

➢ *Interactive kiosk and multi-touch surface/screen*

An interactive kiosk is a computer station set up in a public space for public use. First developed in the 1970s, the digital public interactive kiosk was made possible by the rapid advances in computing technology. The personal computer allowed performing complex computing from a small desktop space. According to Oxford Dictionary "A kiosk is defined as a fixed terminal that uses a computational system to provide information, incorporating one or more interactive display screens." The configuration of the kiosk can be done in line with the objectives of the organization, things to include, navigation style: one finger or more and how many people will use it at a time (Kidd et al., 2011).

A study on kiosks set up in various museums was conducted by Mr. Hall. In most cases these kiosks were not presented attractively: since a lot of information can be accessed from a kiosk (such as text, pictures, videos, or various games), this may not be ideal for group use (Hall, 2013). As a result, it spreads a bad impression among the viewers. On the other hand, multi-touch screens are more interactive than kiosks. Because it can be used by many viewers at the same time: a multi-touch screen can take input of two or more fingers at the same time.

A multi-touch project has been completed at the Gallery One of the Cleveland Museum of Art in the United States and is named ARTLENS Gallery. Although it was launched in 2012, it was reformed in 2016. About 4100 artifacts from important collections of various museums of the world are displayed on the 40 feet wall with this mentioned technology. This huge interactive wall can be used by many visitors at the same time. Touching a picture of any artifact displayed on this wall will enlarge the picture of the artifact and display more detailed information about it.

The Copper Hewitt Smithsonian Design Museum in New York City, USA, is another example of a more aesthetically pleasing display of artifacts through digital installations. The museum has been using a number of high-resolution multi-touch tablets since 2014 for interactive communication with viewers. This allows visitors to browse their preferred section; for example, one can learn about each artifact through the Collection Browser Area, one can gain knowledge of the history of the installation and its architectural design through Mansion History, and the interrelationship between donor and organization can be established through People Browser Area.

Touching the multi-touch screen of The Memory Pool at the Los Angeles Museum of Holocaust displays images from the table as if it were floating on water. These pictures show the life of the people before the holocaust- social life, sports, going to and from school, attending various festivals, etc. When any of these images are touched, detailed information about that image pop-up on the screen. On the other hand, even if someone touches some pictures; no information is available about them. These images continue to be faded away; which reminds that these memories/pictures are lost in the holocaust (Potion, 2021).

The Science Storms exhibition at the Chicago Museum of Science and Industry, which was inaugurated in 2010, provides scientific explanations for natural disasters, such as tornadoes, Tsunamis, and thunderstorms. This interface displays in real-time the reaction when water is poured on the fire through a touch screen; there are also measures to reduce or increase the flame. In this way, the general audience also gets a scientific consensus on various issues.

➢ *Interactive Projection*

Museums around the world have introduced Interactive Projections to increase the museum engagement with visitors inside the museum premises. An excellent example of this is Pure Land: Inside the Mogao Grottoes at Dunhuang. Mr. Julian Raby, Director of Arthur M. Sackler Gallery and Freerer Gallery of Art, Smithsonian has explained as "It's an experience that connects with the future". It is an Augmented Reality (AR), representing a cave of the Tang dynasty. This cave is also known as 'Caves of the Thousand Buddhas' which consists of 650 caves. This Interactive Projection system has 45,000 square meters of mural paintings and 2,000 painted sculptures. This Mogao Grottoes cave is included in the UNESCO World Heritage Site. It is engaged in a surrogate true-to-life experience of being inside this cave temple and seeing its magnificent Buddhist wall paintings at a one-to-one scale (Kenderdine, 2021). Collections of this installation can be enjoyed in 360-degree view by represented in high-definition digital images.

Pipilotti Rist: Pixel Forest at the New Museum of New York City is a video art and multimedia presentation that creates an interactive audio-visual environment. In this installation, video and photo have been projected on the walls, ceiling, floor etc. Entering the exhibition, visitors will experience a variety of aesthetic experiences. Rist's video art is viewed through a pyramid-shaped viewing booth, a new concept. The main purpose of this exhibition was to increase the intimacy of human with nature.

Interactive access to over 60,000 collections is available through mARChive at Museum Victoria in Melbourne, Australia. In this case 360° 3D screen has been used. Applied Visualization Interaction Environment (AVIE) technology has been used to create mARChive. It uses a cylinder-shaped 12-channel stereoscopic projection system and a 7: 1 surround audio system. AVIE's mixed-reality created interactive communication with visitors using the information projected on the screen. Technically it uses active stereo projection and camera tracking. (Kenderdine, 2021) said, “using a tablet to browse and select images, and 3D glasses to visualize them, the immersive cinematic experience is augmented by the possibility of examining the high-resolution images, at one to one scale, with descriptions of the objects”.

- *Virtual museum:*

Virtual museum can be defined as a collection of electronic or real-world artifacts and information resources-virtually anything that can be in digital form or collected. The collection may include paintings, drawings, photographs, diagrams, graphs, recordings, video segments, newspaper articles, transcripts of interviews, artifacts and a host of other items which may be saved in the virtual museum’s electronic file or gathered, and displayed (McKenzie, 1995).

According to Holdgaard, 2011, virtual museum does not have a defined concept, it may include online museum or electronic museum, hyper museum, digital museum, cyber museum, web museum, or other names (Vaz et al., 2018). Regardless of the name, the virtual museum will be based on a digital database that can be found online and can be identified in three ways - focused on the content, communication & collaboration and connected to museum's core concept (Geser, G. & Niccolucci, 2012; Holdgaard, 2011).

A museum's website not only provides information support, but also connects visitors to social media such as Facebook, Twitter, Instagram, Pinterest, various pictures and videos, short discussions about different patterns, blogs, small blogs, etc. ((Freeman et al., 2016; Geser, G. & Niccolucci, 2012; Johnson & Witchey, 2011). Carvalho, J., & Raposo, 2014, states that users may have a particular tendency towards a particular choice that may be interactive or even virtual. That's why website-based activities of users help build, enhance and expand the museum's knowledge base, and create new trends in museum-user relationship. At present, if a museum is properly represented on the Internet, it will create potential visitors.

The widespread use of websites and social media over the past two decades has raised a question: Will the physical museum be lost in the virtual world? From the very first day of photography technology, a lot of controversy has started about it. However, many people agree that no matter how much virtual technology comes to the fore, the need for a physical museum will not be lost. Vaz et al., 2018, mentioned, virtual space will act as a bridge between physical and virtual museum, in this specific scenario.

The Louvre Museum in France can be considered as a proper example of this bridge. Museum maps can be downloaded through the various tools provided on the museum's website, interactive virtual tours can be completed on each floor and room of the museum; there are 360 ° images and interactive 3D tools to help with this. There are also mini-websites for specific art work, quick documentaries titled "eye-openers", and access to huge databases for visitors through catalogs; in the designated area for researchers, for example, there is a scheduled visit for fragile collections.

Considering the Bangladesh National Museum, its Virtual Tour (www.vt.org.bd) is particularly noteworthy, it attracts visitors. It is also known as Virtual Gallery. The gallery of Bangladesh National Museum can be visited virtually from any computer or mobile device without any fee. This includes almost every artifact displayed in the museum's gallery. A picture with a brief description pops up when a viewer clicks on a specific artifact. In this way virtual communication is established with museum enthusiastic person who does not have the time to physically visit museum. Virtual tours of Bangladesh National Museum have become quite popular during the global Corona pandemic.

As a way to enhance real-life experience, Google Art Project has made it possible to virtually visit museums around the world. With this tool, it is possible to observe any pattern well, in the case of a surface of paintings; it can even surpass real-life experience. In this way technical and aesthetic studies are possible which may not be under direct inspection.

Project VanGo Yourself organizes interactive virtual exhibitions using social media and creates various contents. It's basically a website that offers the opportunity to recreate world-famous paintings. Enthusiastic visitors can choose his/ her favorite list from various museums included in VanGo Yourself project. Whenever a picture is created based on some ideas, the user uploads it to their website, and it replicates to social media to create an interactive communication.

The iconic British Museum allows visitors to tour the Great Court virtually and discover the ancient Rosetta Stone and Egyptian mummies. They have a partnership with Google Inc. to make it happen. By clicking https://britishmuseum.withgoogle.com/ enthusiasts can find hundreds of artifacts on the museum’s virtual tour. The tour starts with AD 2000 with five groups: Africa, Americas, Asia, Europe, and Oceania. The National Museum of Modern and Contemporary Art, Seoul also uses Google’s virtual tour to explore six floors of contemporary art from Korea and all over the globe. The virtual tour is also available on mobile platforms, i.e., iOS and Android. The tour is divided into eight (8) stories with 340 items. The National Gallery Singapore has created an

online exhibit titled 'Stories in Light: Four Modern Photographers in Singapore' in response to COVID time It has an audio guide to help the visitors. User can also download Gallery Explorer app. It is considered as a perfect museum companion guide for self-guided tours. The virtual tour of Canadian Museum of History provides the opportunity to explore the journey of the country and its people. Visitor can discover the events, personalities and historical currents that have shaped Canada — from time immemorial to the present day.

It is clear that in a sense, Digital museums need to be considered as an alternative to traditional museums. The real experience of standing in front of an artifact can never be replaced by virtual experience, but it adds another dimension. It is a means of communication with the public and museum experts where there will be an attempt to give a detailed idea about the artifact.

- *Mobile Application*

According to (Freeman et al., 2016), "Portable devices like smartphones, tablets and smartwatches became ubiquitous and, in addition to allowing connections to the Internet, also include built-in cameras and sensors that enable the interpretation of the real world, which can contribute, in some cases, to stimulate new interactions with collections and museum spaces." At present, almost every visitor who comes to the museum has a mobile phone or similar device in his hand, so the benefits can be taken by creating various mobile applications. (McMullan, 2015) says that for a museum-to-mobile application to be successful, it must have the ability to connect visitors with the museum theme as well as attract everyone. An example is the SFMOMA application created by the San Francisco Museum of Modern Art. Through this specialized application, visitors can view the presented patterns as well as hear the details of them while traveling in the museum; though it should not be mismatched with Audio-Guide. This application, created by Apple, uses virtual map technology; location-aware technology on their mobile is used phones to determine its location and play immersive audio in keeping with the patterns presented in the museum.

Spain's Museo del Prado's Second Canvas application allows you to enjoy 14 of the museum's permanent art-work in giga-pixel resolution. Super-zoom, ultraviolet or infrared or X-ray vision technology can be used to learn more about the patterns. These features are exclusive to the mobile application and web interface. Even cropped images can be shared through Facebook or Twitter. During the creation of this application, the director of Museo del Prado, Mr. Gabriele Finaldi said that, the main purpose of creating this application is to present art-works in a better and easier way; to represent each work of art in a deeper level; and in spare time, to provide the opportunity to do research on own device. It should be noted here that this application was originally created for iPad or iOS but now it is also developed for Android platform.

Augmented Reality (AR) is used in SopifyROM at the Royal Ontario Museum in Canada. This allows visitors to attach skin to dinosaur skeletons through their mobile devices, view animals alive, and observe almost destroyed specimens in their original state; even ancient languages can be translated! Oliveira says with this AR application, it can show x-ray view of the specimen; by scanning the QR code, it can provide detailed information about the various artifacts on display through video or audio or text or interactive graphics.

The Brooklyn Museum in New York created the ASK application in 2014 to bridge the gap between visitors and museum experts. The very purpose of this application is found in its name. Visitors or interested people about the museum can ask the museum experts and the answers are available in real time. This application has the opportunity to send pictures or videos of the relevant subject / pattern along with the answer to the question. One year later, in 2015, the then Digital Initiatives and Chief Experience Officer of the Barnes Foundation, Mr. Shelley Bernstein said that, the level of communication with visitors through the ASK application is much higher than with previous technologies such as comment kiosks, mobile tagging or QR code scanning.

- *3D-Printing and Scanning*

3D scanning and printing technology enhances public interaction with museums collection. A general visitor to a museum usually views any artifact inside glass case or inside a showcase or sees in the middle of a somehow bound frame; but using 3D printing technology one can experience the object with one's own hands. Because, it recreats an artifact which can be displayed, even given the opportunity to touch and feel for the visitor, without damaging the original piece. Its usage has increased with the advent of 3D printers. Any artifact can be scanned thoroughly in 3D and the file can be uploaded to software and then printed.

The Art Institute of Chicago in the United States is using 3D technology. By doing so, they are creating three-dimensional replicas of specific patterns, giving the viewer a chance to touch them. These replicas are usually made in a 1:1 ratio. These 3D printed replicas may not be perfect, but the original pieces are well preserved so that they do not come in close contact with humans.

The Manacor Museum of History in Spain began its journey in 1906 on the island of Mallorca. Among the notable collections of this museum are archeological, ethnographic and industrial collections. They use 3D technology to give viewers the opportunity to touch their artifacts. In July 2016, the museum exhibited 12 artifacts in an exhibition. It was an unimaginable experience for the audience. Earlier, these artifacts were in the glass showcase, but now one can feel them with their bare hands.

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The Smithsonian Institution is a prime example of the use of 3D technology in museums. It is simultaneously one of the largest museums, education and research complexes in the world. The Smithsonian Institution has museums, libraries, research centers and even a zoo. The collection is more than 1.5 million. It is impossible to physically display such a huge collection. Only 1% of total collection is being displayed (ANATOL, 2019). In this context, it was decided to use 3D technology to represent the collection and its information to a wider audience. All 3D scanned collections can be experienced through the Smithsonian Institution's 3D digitization portal. Even 3D scanned files of these objects can be downloaded and printed using a 3D printer.

Joseph Greene and Adam Aja, two archaeologists, created a 3D replica of a ceramic lion statue in 2012. The lion statue was damaged 3,000 years ago in Nuji, ancient Mesopotamia located in modern day Iraq. Photographs of the lion's broken fragments were taken from more than 100 angels using photomodeling. It is then printed by a 3D printer and is on display (FLAHERTY, 2012).

➢ *Findings on Enhancing the Visitors Experience*

The young visitors are very much familiar with new technologies. They wish to use the latest technology in their day-to-day life. The museum field is also a part of it. According to the face-to-face interview with the museum visitors, it is evident that people are eager to have all museum facilities at their fingertips. Among the 60 participants, 45 were college and university students, 10 were young professionals, and 5 were aged people. The college and university students group is tech-savvy. They already use the latest technology and encourage the pervasive use of technology in museums. This group is fond of AR/ VR technology, interactive projection, virtual gallery, kiosks, multi-touch screens, interactive museum exhibitions, etc. They virtually visited the Louver museum, the British Museum, the Cleveland Museum of Art, etc. They wish to get the same experience in this country's museum. They expressed that the museums of this country should incorporate more digital devices, i.e. audio guide pods, touch screens, digital kiosks, augmented reality, and virtual museums. Among the 45 students, mobile application was the priority in the list of technologies whereas virtual reality was in the second position (25 students).

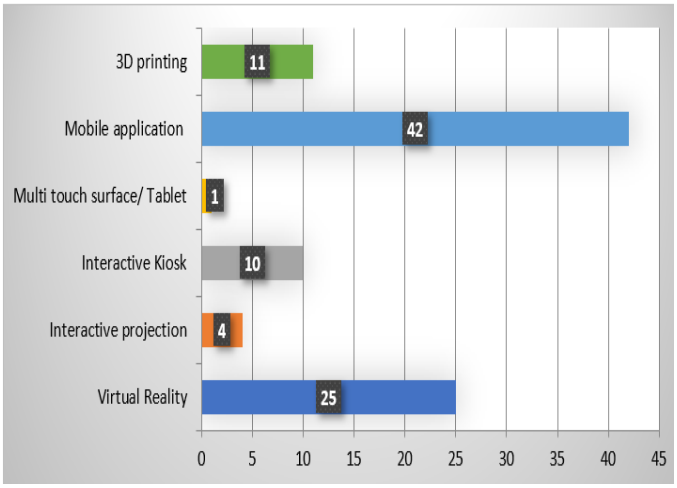

Fig 1:Technologies Mostly Used by Students of College and University

At Figure-2 young people from different professions, who were 10 in number, opined they have less time to visit all the galleries/ collections displayed in a museum. But they want to have the full experience of a museum in less time. This group expressed having the museums at their fingertips. Online ticket booking facility, audio guide, mobile application, YouTube videos about artifacts, and interactive exhibitions online are among the list of their expectations.

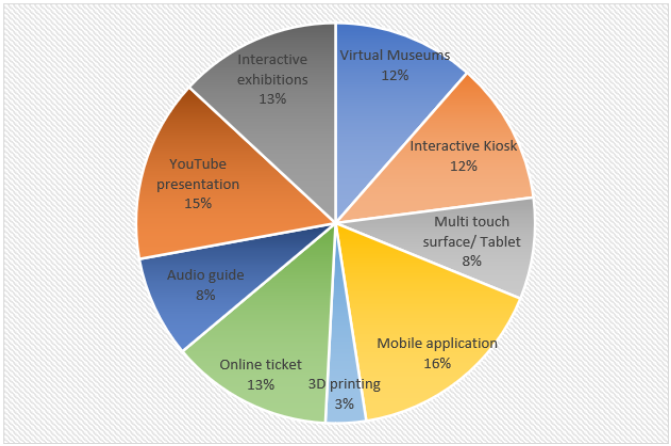

Fig 2: Young Visitors – of Different Professions – Expectations

The third group (Figure-3) consisted of 5 respondents whose age was between 35-65, and who expressed interest know the heritage through digital media. According to them, roaming through a whole museum is a great way to enjoy the collection, but their physical condition restricted them to do so. This small group wished there is a mobile application or digital media (21%) which can be a great aid for them. According to them, it will cost less time and open a broader aspect.

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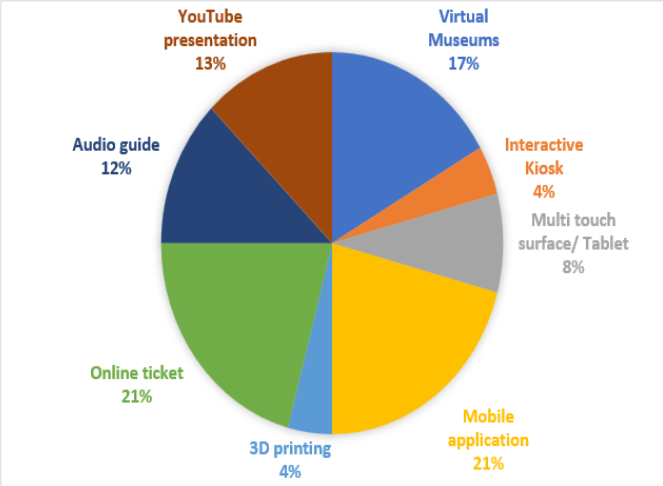

Fig3: Aged Visitors' Expectations

When asked about the satisfaction level of technologies the response of all groups as follows:

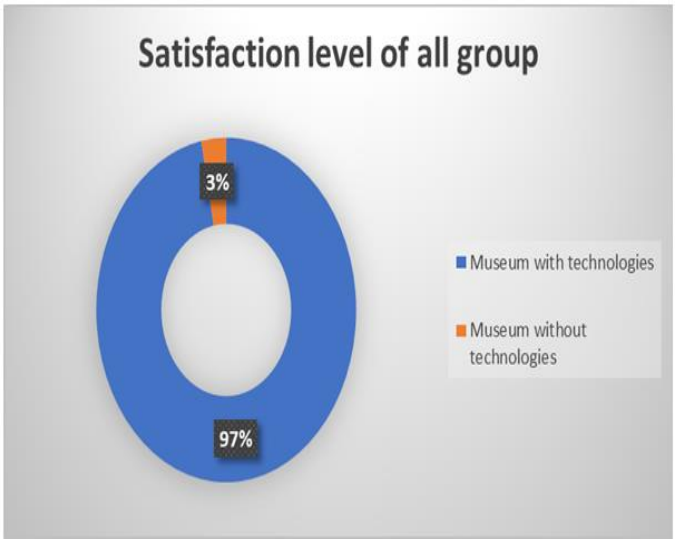

Fig-4: Satisfaction Level of All Group

Technological advent never stops. Those who adopt it can survive in the long run. Many professionals, as well as institutions, have adapted to new advances in technology.Technology has certainly made our day-to-day lives easier; however, in the industrial field technology is taking its place: including museum professionals. In the field of museum studies, museum professionals are tasked with balancing visitor's engagement, enjoyment and achieving their set education goals when they design exhibits (Irizarry, n.d.). While a museum specialist may be excited about a particular exhibit, it may not even grab the attention of public. Due to COVID-19 pandemic, the museum world shook up like no other before in 2020. Most of the museums of the world had to shut the door to visitor in this time. A survey was carried out from 2018 and continued to 2020 to know how new technologies and innovations will have an impact for museums.

The survey's recurrent question was "To which degree (0 - not relevant at all; 10- extremely high) will new technologies contribute to the success of your institution in the future?" For the 2020 edition, this same question was divided into three: the relevance of technology for museum at the beginning of 2020, i.e., before, during, and, finally, as estimated for the upcoming three years (Eid & Forstrom, 2021). The result of 2023 is an expected calculation against 2018, 2019 and 2020:

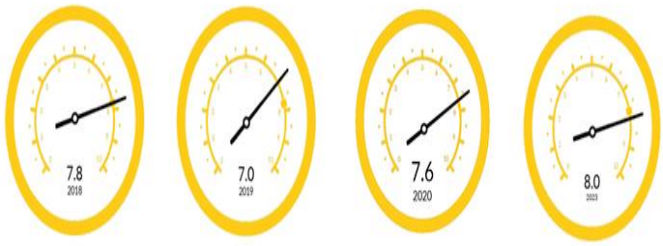

Fig 5:Impact Measurement of Digital Devices (source: (Eid & Forstrom, 2021)

The technological advancement has resulted museums pivoting to digital age. Museums around the world jumped on the digital bandwagon to make them relevant and connect with audiences. The future of museum now drives towards hybrid and it will continue along with physical installations. The Virtual Museum of Luvor, France gained 10.5 online visitors in 71 days (12 March 2020- 22 May 2020). Among the online visitor, 17% was of France and 17% was of USA. In 2019, the physical visitor was 14.1 million (Ledsom, 2020). Thus the user expects a lot of recent technologies which enhance their museum visit.

A breakthrough imapct of more museums going digital was gaining new and more diversified visitors. Audience engagement has become more prominent. The digital contents of museums became more visible and available regardless of geography, open for those who could not visit the museum physically due to diverse reasons, enabling them to wander through the digital halls and see what museum collections have to offer, oftentimes way beyond the constraints of exhibition displays. Google Art project offers 'Armchair Tourist' facility to physically challenged people. They can enjoy the worlds one of the biggest exhibition with a tap on the screen (Ionescu, 2012). Even art teachers and students can get a taste of virtual field trips; at the same time, it can communicate remotely with museum experts or experts in other specific fields (Stanisławski & Pielesiek, 2012). According to art experts, the Google Art Project will greatly increase the interest of visitors in online exhibitions; Google Art Project has strengthened the word base. Within 14 days of the start of the project, the website traffic increased by about 7% over the normal period (Berwick, 2011).

The main purpose of the ARTLENS Gallery project was to determine the relationship between art and general knowledge of the public or visitors visiting the museum.

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'ARTLENS Gallery visitors went from an average score of 5.7 to 6.3 during their visit, while other visitors went from an average of 5.9 to 6.1. Furthermore, ARTLENS Gallery visitors were also more likely to feel interested as a part of their visit' (Cleveland Museum of art, 2019).

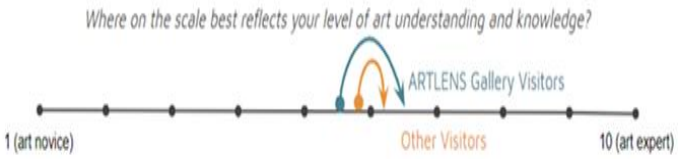

Fig 6: Visitor experience of ARTLENS gallery (Source: (Cleveland Museum of art, 2019)

If artifacts of an art gallery or a science gallery of a museum in Bangladesh is taken as a pilot basis to convert into an interactive exhibition like the Google project, the visitor will feel more interested to visit. Thus more visitors will engage themselves which may include native as well as foreign visitors.

Twenty-first century trends point towards the establishment of virtual museums, where the collections of a museum will be in an online database and audience can access those. The COVID-19 virus spread expedited this process when more than 85,000 museums of the world were closed in March 2020. The museum professionals needed an answer to battle this situation (Voigt, 2020). Many museum specialists found ways to bring the museum and its artifacts online for all to enjoy. According to the Network of European Museums Organizations' COVID-19 report, more than 70% of European museums ensured their online presence with virtual tours and events. The report also states that two out of five museums reported an increase in visits to their websites, ranging between 10 to 150 percent during the reporting time (Network of European Museum Organisations., 2020). The figure below shows that, online contests and quizzes, posts in social media and online/ virtual exhibitions have gained online visitors (Irizarry, n.d.).

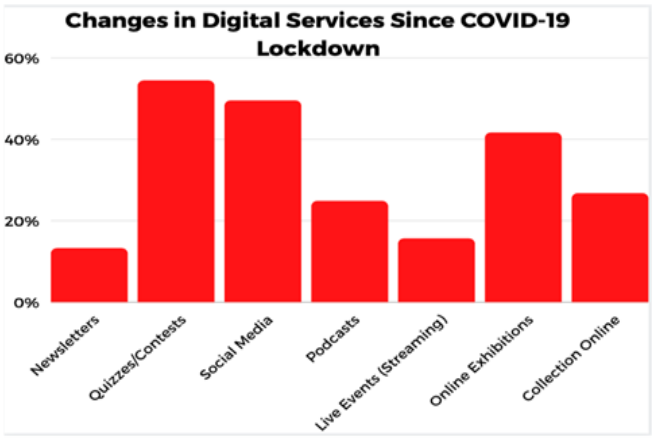

Fig 7: percentage of online visiotrs (Source: (Irizarry)

Marc Gilmcher, CEO of Pace Gallery, spoke on his institution's decision to move online in an interview with The Guardian in April 2020. He explained that their "hope for these exhibitions is to use the voices of our dealers and curatorial team to create multi-media environments …this is just the beginning of experiencing art through digital realms" (Voigt, 2020).

Bangladesh National Museum has introduced Curators' Corner in COVID-19 pandemic situation. In those videos of the said corners, one artifact is presented in front of the viewers. They get intensive knowledge about that specific artifact. It has gained popularity among the online community. Viewers also interact with comments and like/ dislike.

Establishing a digital installation involves infrastructure development, content creation, maintenance and others. Though, many museums offered digital content without any cost for audience, the authority can take the opportunity to generate revenue out of the digital content! The Barnes Foundation is well known for facilitating art education over the course of the last century. COVID-19 interrupted this process, though shortly, the long-standing endeavour of the institution. The foundation a plan to introduce online classes, even before the pandemic started, but the virus served as the last needed push wiping away persistent doubts on profitability and engagement rates. The idea was put into practice and one year later. The Barnes Foundation finds itself leading the field of online art history education in the US. The virtual classes were well accepted by its students causing a clear financial success. Within the first month of shifting to online, about one-third of the previous year's adult education revenue was reached. The earning was more than $650,000 since its launch last March—which was more than double than that in-person classes had generated in 2019 (Eid & Forstrom, 2021). Not only the revenue increased, but also students (more than 2,800 students from 39 states and six countries) and international curator and art-historians contributed in this time frame.

Mobile application and games always attracted bigger audiences. By 2020 younger audiences involved into playing museum centric games. Nintendo Switch is a vastly popular gaming device. Animal Crossing: New Horizons game for Nintendo Switch created an unprecedented popularity in 2020, gaining over 13 million players. The gameplay involves players to create their personal dream island lifestyle from the comfort and safety of their homes (Eid & Forstrom, 2021). Renowned museums like the Getty (Art Museum in California, Los Angels), the Cincinnati Art Museum (Art Museum in Cincinati, Ohio) and The MET quickly jumped on the bandwagon. They added their collections into the game. The Thyssen-Bornemisza National Museum of Madrid, Spain, in their turn has taken the whole Animal Crossing experience to the next level by recreating the museum virtually and even offering short guided tours through its halls. The interesting fact is: to celebrate the International Museum Day, Nintendo also invited players to

participate in a special two-week stamp rally between May 18-31 in order to gain special rewards.

Mobile application created by museum authorities plays a prolific role to engage people. The SFMOMA android application of San Francisco Museum of Modern Art already have more than 10 million installations, Second Canvas of Museo del Prado also have more than 10 million installations. The numbers are increasing day by day.

This study shows that, in lieu with the world scenario, the number visitor will be increased and will be satisfied.

IV. CONCLUSION

The use of technology in museums has historically provoked a lot of arguments among museographers, museologists and museum visitors. One segment argues in disfavor in the sense that museums should not use technology and the visitor should only focus their experience around the aura of the artifacts and other group favors on the ground that, as technology gaining its dominance than ever, many institutions feel, including technology will increase the interaction between the exhibits and the visitors. Now, Where the ideal balance lies is the cause for the ongoing debate. The introduction of virtual museums has saved countless institutions from closing their doors permanently. They now are responsible for deciding how they, and the future of museums, will move forward, permanently reshaping traditional museum roles. On the other hand, measuring the applicability of the technologies will pave the way about how much meaningful – effective and efficient- which types of technologies will be in the long run and when to install and where not to. So setting up technologies depends on museums visitors and other significants areas of museums. Any initiative regarding the technologies in museums cannot be left behind or beside without their adaptability measures from time to time. New technologies for museums can enhance visitors' experience if measured actions are taken from time to time. Like other studies, this one has showed the satisfaction level of using the digital technologies enchance the visitors experiences.

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