DIGITAL TECHNOLOGIES IN MUSEUMS: QR CODES AND INTERACTIVE VISITOR EXPERIENCES

O‘zbekiston amaliy san’at va hunarmandchilik tarixi davlat muzeyi
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Annotatsiya: Ushbu maqolada dunyo muzeylarida, xususan O‘zbekistondagi muzeylarda raqamli texnologiyalar, ayniqsa QR kodlar joriy etilishi va ahamiyati yoritilgan. QR kodlarning yaratilish tarixi, COVID-19 pandemiyasi davrida muzeylar faoliyatida yuzaga kelgan muammolar va ularni hal qilishda raqamli vositalarning roli tahlil qilinadi. O‘zbekistonda muzeylarni zamonaviylashtirishga qaratilgan davlat dasturlari va ilg‘or amaliyotlar haqida ma’lumot beriladi.

Annotation. This article explores the evolution and integration of digital technologies—particularly QR codes—in the operations of museums globally and in Uzbekistan. It highlights the historical background of QR code development, the impact of the COVID-19 pandemic on museum attendance, and the digital solutions adopted in response. The study emphasizes Uzbekistan’s efforts toward modernization through state programs, digital exhibits, and visitor engagement strategies using technologies like 3D scanning and QR code systems.

Аннотация: В данной статье рассматривается внедрение цифровых технологий, особенно QR-кодов, в деятельность музеев по всему миру и в Узбекистане. Освещается история создания QR-кода, влияние пандемии COVID-19 на посещаемость музеев и роль цифровых решений в преодолении этих вызовов. Также анализируются государственные программы и передовой опыт по модернизации музейной сферы в Узбекистане.

Kalit so‘zlar: QR kodlar, muzey raqamlashtirish, Raqamli texnologiyalar, COVID-19 pandemiyasi, Virtual ekskursiyalar, O‘zbekiston muzeylari, interaktiv tajriba, Madaniy meros, 3D texnologiyalar, Zamonaviy muzeylar.

Key words: QR codes, Museum digitization, digital technologies, COVID-19 pandemic, Virtual tours, Museums of Uzbekistan, Interactive experience, Cultural heritage, 3D technologies, Modern museums.

Ключевые слова: QR-коды, цифровизация музеев, цифровые технологии, Пандемия COVID-19, виртуальные экскурсии, Музеи Узбекистана, Интерактивный опыт, Культурное наследие, 3D-технологии, Современные музеи.

Today, museums are not only considered institutions for preserving historical and cultural heritage, but also as innovative centers that deliver this heritage to the broader public using modern technologies. The advancement of information technologies—particularly digitization, QR codes, mobile applications, interactive screens, and artificial intelligence-based systems—has introduced significant innovations into museum operations. These transformations are turning museums into hubs of education, cultural exchange, and tourism, beyond being merely sources of information. In Uzbekistan as well, modernizing museum operations has become one of the key priorities. On one hand, this process increases public interest in national history and culture; on the other, it plays an important role in promoting Uzbekistan's rich cultural heritage on an international scale. In recent years, attention to museums in the country has grown considerably. Currently, there are 140 state museums operating across the republic. These include 75 history museums, 23 regional studies museums, 10 art galleries, 20 memorial sites, 8 literary museums, and 4 natural history museums. More than 1.6 million exhibits are preserved in these institutions.

The majority of museums around the world including uzbek museums had to close in 2019 because of spread of COVED-19. As a result, the number of museums in the world is estimated to be close to 104,000I but these institutions are not evenly distributed: 61% of the institutions are located in Western Europe and North America, 18% in Asia-Pacific, 11% in Eastern Europe, 8% in Latin America and Caribbean, but only 0.8% in Africa and 0.7% in the Arab States. 83% of the States responding to the survey took measures to close in 2020, either totally or partially, for periods ranging from less than a month to a year. On average, these closures were adopted for over 150 days in 2020. Museum attendance has fallen sharply in all States. Even for institutions that remained open The role of the digital sphere is presented, in the 2015 UNESCO Recommendation concerning the Protection and Promotion of Museums and Collections as a significant challenge for museums worldwide. The report on the implementation of the Recommendation, published in 2019, as well as Museums around the world in the face of the COVID-19 published in 2020, referred to the importance of digital technology in the context of the health crisis and lockdown measures. Both reports also presented the difficulties caused by the digital divide between different regions, especially in those where the museum network is still fragile, in Africa and in Small Island Developing States. The implementation of a digital policy is based on a global reflection that takes into account at the same time internet access, the digitization of collections (itself based on the inventory of the collections), a minimal IT infrastructure (photography, scanners, computers), and above all, a staff with the necessary skills and time to carry out these tasks. As noted in previous reports, the all-important collection inventory issues have not been resolved for all institutions, and few museums have staff dedicated to the digital strategy of their

institution. This was again mentioned by Member States, which also reported, like Kenya, on their efforts to improve virtual visits by digitizing more exhibitions. Comoros also offered training during the pandemic in computerization, database creation and digitization of collections. Ideas of implementing digital technologies in the museum appeared in 1990s.

This is because, The advent of modern computing in the 1990s marked a transformative era for the museum sector, leading to substantial improvements in information systems and data transmission capabilities. The acquisition of computer proficiency among museum professionals and the creation of an integrated digital network offered numerous advantages for the documentation of museum collections. For instance, the introduction of digital cameras enabled the capturing of exhibit images, which could then be directly uploaded to computers. These images, along with associated analytical data and other relevant information, could be enhanced and updated by experts as necessary. This transition significantly elevated the quality of the dynamic catalog and card index systems utilized in museum operations.

The arrival of the Internet further accelerated this process on a global scale. Today, by visiting sections like “Museums” and “Culture” online, one can virtually tour museums around the world. In addition to general information, these sites provide access to collections, news, special events, academic conferences, and even contact details and email addresses of museum professionals. According to information released by the AMICO consortium in the United States, the Internet hosts a card system with images of more than 2.5 million museum exhibits. Museums in Uzbekistan are also working on developing their own websites. For instance, the Bukhara State Architectural and Art Museum-Reserve has begun gradually addressing the need to equip museum staff with personal computers. The museum has made progress in connecting to the Internet, developing a website, and creating a digital database. As a first step, work has begun to transfer the museum’s manuscript collection to electronic laser discs. In general, museums across Uzbekistan are gradually advancing in this field.

In accordance with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated December 11, 2017, titled “On the Approval of the Comprehensive Program for Improving the Activities of State Museums and Strengthening Their Material and Technical Base for 2017–2027,” significant steps have been outlined to modernize the operations of state museums. The resolution emphasizes the enhancement of museums’ material and technical infrastructure as well as the acceleration of digitalization processes. Within the framework of this resolution, specific measures have been set for the digital transformation of museum activities and the creation of virtual museums. One of the key initiatives involves the introduction of 3D technologies**,** enabling the digitization of museum exhibits in 3D format for virtual

presentation. This plays a crucial role in making rare and ancient artifacts accessible to a wider audience through virtual means. Another one of the key initiatives involves usage of QR code in the field of museums. The use of digital technologies in museums—especially QR codes—serves as an effective tool to provide broader and deeper information about exhibits, create interactive experiences, and increase visitor engagement. History of creating QR code dates back to 1990s year.

During the 1960s and 1970s, while Japan was still adopting barcode technology, the company Denso Wave began receiving requests from industrial partners—reportedly including Toyota, its parent company—for a more advanced machine-readable code. Barcodes at the time could only hold about 20 alphanumeric characters, which was insufficient for manufacturers who often had to apply multiple barcodes to a single product, slowing down the scanning process.

To address the limitations of traditional barcodes, Denso engineer Masahiro Hara began designing a new type of code. Moving away from the conventional linear bar format, he created a square-shaped design composed of pixel-like elements, drawing inspiration from board games. His aim was to significantly increase data capacity and improve scanning efficiency.This effort resulted in the development of the Quick Response (QR) code) in 1994, originally intended to help track automobile components more effectively during the manufacturing process. Unlike one-dimensional barcodes, QR codes are two-dimensional and can hold extensive information, including text, web links, and even multimedia content. In Asia, QR codes gained widespread use thanks to their integration with popular payment platforms like WeChat and AliPay. However, in the UK, their adoption remained very limited until more recently. In fact, QR codes were often seen as something of a gimmick in UK and US museums, which typically struggled to find meaningful uses for them. Many museums also resisted incorporating them, fearing they would clutter carefully designed exhibit labels and signage.

Despite this, QR codes started to appear in some UK and US museums during the late 2000s, with early examples including The Mattress Factory in Pennsylvania (2009) and the Brooklyn Museum (2012). Their use remained minimal throughout the following decade. In 2016, the organization Cuseum even described them as nearly obsolete in an article titled *The Life and Death of QR Codes in Museums*.

At the time, studies showed that up to 97% of people didn’t even know what QR codes were. This lack of awareness, combined with the fact that most smartphones couldn’t scan them without downloading a special app, led to low engagement. Some visitors also cited concerns about security and battery usage as reasons for avoiding QR codes.

Starting in 2017, both Android and Apple began including QR code scanning capabilities directly in their system updates. This removed a major obstacle, allowing users to scan QR codes with their smartphone cameras without needing a separate app.

By 2020, around 91% of active iOS users had devices with built-in QR scanning, and by 2022, it was estimated that one billion smartphones globally could access QR codes natively.Alongside these technical improvements, the COVID-19 pandemic brought about a major shift in the UK. QR codes quickly became a crucial tool for accessing services and information in a contact-free way. People had to learn how to use them daily—for booking COVID tests, showing vaccination passes, and later, ordering food and drinks in reopened hospitality venues. As one person joked, "You pick it up quickly when it's the only way to get a gin and tonic." In Uzbekistan, QR code usage in museums began to gain traction during and after the pandemic, particularly as part of the 2017–2027 State Program for improving museum infrastructure and digitization. Institutions such as the Bukhara State Architectural-Art Museum-Reserve started implementing QR codes for cataloging manuscripts, enabling both researchers and tourists to access heritage information more easily.

In conclusion, the integration of digital technologies in museums plays a vital role in delivering more comprehensive and engaging information about exhibits, creating interactive visitor experiences, and increasing overall audience engagement. During the COVID-19 pandemic, museums worldwide faced a sharp decline in visitor numbers. To address this challenge, many institutions adopted 3D technologies and other digital tools, including QR codes, to maintain accessibility and enhance remote engagement.Museums in Uzbekistan have also embraced digital transformation. For instance, the State Museum of Applied Art and the History of Handicrafts of Uzbekistan has implemented QR code systems to provide visitors with easy access to detailed exhibit information. Such initiatives reflect a growing commitment to modernizing museum experiences and making cultural heritage more accessible to the public.

List of used literature

1. UNESCO Reports (2020–2021): Museums Around the World in the Face of COVID-19.
2. O'zbekiston Respublikasi Prezidentining Farmoni, 2017-yil 1-mart, PF–4947-son — "Harakatlar strategiyasi".
3. Smithsonian Institution. "QR Codes in Museum Exhibits: Connecting the Physical and the Digital." Smithsonian Digital Strategy Blog, 2021.
4. P. Williams. Using QR code in aid accessibility in a museum. November 2012
5. https://www.uniqode.com/
6. https://blog.nms.ac.uk