

Concept for Use of Consumer Mobile Devices and Smart Applications for Preservation of Cultural Heritage

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Abstract. One of the challenges to the digitalisation and preservation of the cultural heritage is the need for expert human labour and specialized hardware/software. With the advent of sophisticated personal smart mobile devices and applications, we expect that soon every citizen will be able to participate and contribute to this process.

Keywords: Internet of Things (IoT), Smart Device, Cultural Heritage, Cloud Technologies, Mobile Application.

1 Introduction

Time is the greatest enemy of the cultural and historical heritage. Whether it's a sculpture, a painting, an architectural work or a unique stained glass, material objects are temporal, and in some time cycle they inevitably deform, change, or destroy. Accordingly, all traditional techniques for the preservation, conservation or restoration of these items are not able to preserve or reproduce them over the millennia in their authentic state, and whether they would survive for several dozen years or several centuries, the preservation of the original object as created is practically impossible in the context of the human civilization or at least was supposed to be not so long ago.

However, the development of digital technologies fundamentally alters this paradigm. Although reproduction of the original cultural object remains impossible, precise digitisation allows the preservation of vast majority of its key features, which is sufficient to allow the creation of accurate copies of it, which only specialized equipment would distinguish from the author's work and in practice the vast majority of the aesthetic and historical impact of the respective item would be preserved, regardless of the eras that divide us.

On the other hand, the development of many scientific and applied fields such as physical chemistry, fluid mechanics, nanotechnology or development of high-tech composites would help to create the same ingredients or alloys from which the original object was built and combined with the exact dimensions we could have, thanks to the digitalization and the usage of 3D printers or other types of suitable reproducing devices, very realistic copies, indistinguishable from the original.

Even with modern technology, if we had, for example, an exact digital copy of some of the already extinct wonders of the Ancient world, such as, say, the Colossus of Rhodes or the Lighthouse of Alexandria (Fig. 1), we could probably make a very accurate replica that would remain for the future generations, and one of the main reasons why someone hasn't done it so far, is the lack of confidence about the original design, dimensions and proportions. After all, one of the main missions of cultural objects is to transfer of the spirit of the time, and no one would trust a historical object when being aware that its appearance rests solely on someone's imagination, and not on real artefacts and reliable evidence.

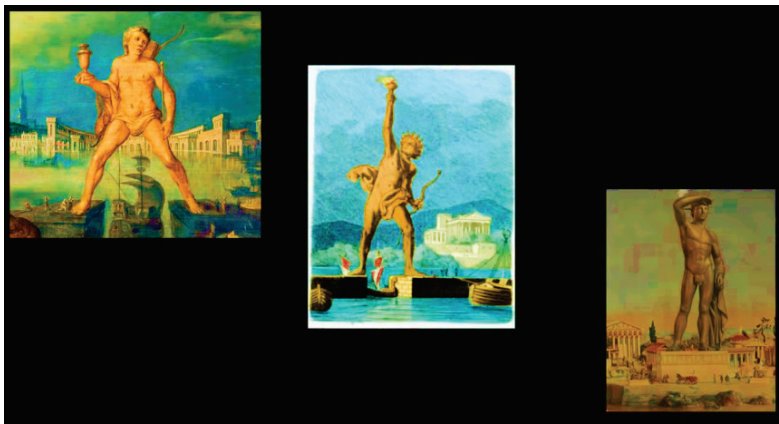


Fig. 1. Various descriptions of the ancient Colossus of Rhodes exist today, but none of them shows a reasonable degree of scientific evidence (Explainer, 2020)

We cannot reverse the time to restore what is no longer there, but since the total volume of cultural and historical heritage over the years has not decreased but increases proportionally with the demographic development of the mankind, as well as with the emergence of new art forms, it is obvious that the problem of historical reconstruction and preservation will always stay on the agenda.

Relative optimism in this regard brings us the fact that most of the new art forms (such as electronic music, computer graphics, holographic imagery, and virtual reality, etc.) are more and more digital in their genesis and, to some extent, their preservation is a solved problem. However, the issue for the classical art forms remains, where everything - from the Egyptian frescoes in the pyramids, through the ancient Greek sculptures or the paintings by the medieval masters all the way to the contemporary avant-garde artists, composers or choreographers presumably rests on more traditional forms of artistic expression (sculpture, fine art, etc.) and is highly vulnerable to the vagaries of time. There is also the case of architectural masterpieces, which due to the specificity related to their material nature, are also transient, although over time modern and more sustainable building materials appear. Having in mind also the threat of natural disasters, wars, bad political and business decisions, or simply poor maintenance, it becomes clear that preserving the cultural and the historical heritage is an extremely challenging

task and serious efforts, financial, technological, and human resources are needed, as well as a commitment of the whole society to its successful accomplishment.

2 The Development of the Knowledge Economy, Mobile Technologies, and Mass Manifestation of Digital Way of Thinking and Acting

The development of digital technologies in the second half of the 20th century, and especially at the beginning of the new millennium, has dramatically influenced the traditional way of life, work and thinking of both individual citizens and societies in general (Castells, 1998). Within just a few decades, humanity has entered the digital age, changing businesses, industries and jobs (Berger, 2016) at an unprecedented rate and scale by positioning the new economy in brand new dimensions - those of knowledge, putting the potential of the human intelligence and creativity at the forefront (Toffler, 1980). Although traditional natural resources and materials continue to make economic sense, in the new reality it has suddenly emerged that the leading positions are occupied already by people and companies who are able to look at the world in a new way, who discover and implement innovations that totally change the rules of the game and who are able to bring high added value to those who are trying to break stereotypes. It is no coincidence that eight out of the ten of the world's largest companies are closely linked to the IT industry, with only three of them over 30 years old and others, such as Meta (formerly Facebook), Nvidia and Tesla didn't even exist before this century.

Many of the daily activities were digitised, within literally a dozen years, the GPS systems displaced the traditional maps forever, and the smartphone became the most important item in the modern citizen's life. Thousands of professions were transformed, hundreds disappeared irrevocably, and many new, presumably digital, jobs were created. The digital content, created in the last few years is times bigger than everything accumulated in all the millenia of human history and digital libraries became a natural part of our lives' ecosystem (Paneva-Marinova, Goynov, & Luchev, 2017).

People didn't just learn to work in a new way, most of them completely changed their stereotype of behavior (Fig. 2), and even the emergence of sinister phenomena like the Global Pandemic of Covid-19 proved to be just a minor obstacle in the path of digitization, which even used the situation to conquer new theories and demonstrate that learning and working remotely are quite possible and science is stronger than all disasters around the world. In fact, in the last few years, many people have become so accustomed to the digital way of life (Kouzov, 2018) that it is already difficult to imagine what was before, and the lack of internet for many of them would be the collapse of the civilization.



Fig. 2. Digital economy empowered by the IoT ecosystem (Source: freepik.com)

At first glance, it seems rather strange to go back to the idea of preserving the traditional cultural and historical heritage in this totally transformed digital reality, which has completely rearranged the public agenda, but in fact the new technologies, the acquired skills, as well as the availability of a portable and networked smart device literally in every citizen of the planet create unexpected opportunities in this direction.

3 How to Use Innovation to Revive Traditions

Even the most rational strategy for digitization of the cultural heritage requires serious expertise, technology, and resources. Paradoxically, with the mass influx of digital devices among citizens, we are effectively creating an opportunity to solve this problem, enabling everyone to contribute to the preservation of the cultural heritage in their city, region or even area of interest by visiting various cultural and historical locations around the world. In fact, the availability of a mobile device in every citizen gives him access to thousands of applications, many of them with serious capabilities, access to huge databases and powerful systems based on artificial intelligence, which can to a great extent balance the lack of expertise of the particular user. To some extent, the user simply becomes an integral part of a kind of human-machine interface, the input of which receives audiovisual information from the respective cultural object (painting, sculpture, building, etc.), and at the other end of the value chain the relevant expert system processes the information and classifies it, preserving its unique digital characteristics for the generations to come. For example, even the most novice smartphone user already knows how to take pictures, recordings, or even virtual panoramas. There are already a number of mobile applications for which there is no need for specific user skills in order to download any digital characteristics of an art object, it is enough for

the owner to direct his smartphone to the specific item and the software does everything else. At the same time, we must not forget that the portable digital devices are becoming more and more powerful, cameras are becoming better, microphones are constantly improved, and various detectors and sensors being added. In practice, every citizen now carries a mini-expert system in his pocket and using it for the benefit of a massive digitisation of art and historical collections is a feasible task, especially in the context of the constant mobile Internet connectivity and the availability of reliable cloud-based systems, operated by powerful, cultural heritage related AI. A number of the world's major museums like The Louvre are making successful attempts to digitise their collections (Fig. 3), but many of the smaller ones do not have their capabilities and such nationally supported initiatives involving thousands of citizens would significantly contribute to solve this problem.



Fig. 3. Virtual tour in The Louvre Museum (Source: <https://www.louvre.fr/>)

If even a modest percentage of the millions of tourists around the world participate in a similar project for digitization of the cultural heritage and the national and international cultural institutions such as UNESCO and the European Education and Culture Executive Agency (EACEA), lead the process, it is quite possible to create a huge database within just a few years containing all the key features needed to create an accurate copy of the historical and art objects. Of course, not all data will be equally useful, but it is the role of the artificial intelligence systems (Olsher, 2015) to optimize the process and increase its added value. If, for example, in a city of historical significance, each resident simply captures his home from several angles and uploads the photos to a suitable cloud application, there are already algorithms that can successfully generate a real 3D model of the city and in the case of a natural disaster, based on this information, it can be realistically restored. All that is needed to create a critical mass of citizens with a desire to preserve their national and world cultural heritage, as well as

institutions to lead the process and create the necessary databases and user-friendly interfaces so that every citizen could easily join the process.

4 Conclusions

The preservation of the world's cultural and historical heritage is a difficult task, but the entry of societies into a knowledge-based economy (Probst, Raub, & Romhardt, 2000) provides fundamentally new opportunities, arming even the ordinary man with the necessary toolkit that would allow him to take part in the process. A chance, but also a responsibility to the mankind, is to use these modern technological advances to preserve in turn what has protected us as people and individuals (Kouzov, 2019) over the centuries, giving the future generations a chance to experience the magic of art and culture and to feel the spirit of the time of every era, regardless of future challenges, waiting for us.

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- Received: June 05, 2022
Reviewed: June 22, 2022
Finally Accepted: July 07, 2022