Eternal Alexandria: From Ancient Stone to Digital Soul

An Immersive Experience at Qaitbay Fort

Time	Program
12:00 noon – 12:15 pm	**Opening Speeches** Prof. Dr. Ahmed Zayed Director of Bibliotheca Alexandrina Prof. Yasushi Kiyoki, Head of AAII, Musashino University. Prof. Eiji Nagasawa, Director of the JSPS Research Center, Cairo. Dr. Mohamed Taman Head of the Central Administration for Antiquities of Lower Egypt and Sinai, Ministry of Tourism and Antiquities.
12:15 – 12:45 pm	**Immersive Qaitbay Fort Legacy:** **From Sultanate Glory to Virtual Space** Dr. Mohamed Soliman, Researcher-AAII (Project PI). Ms. Doaa Ali, Ministry of Tourism and Antiquities (MoTA).
12:45 – 1:15 pm	**Cyber-physical Archaeology in Data Sensorium** Prof. Hiroo Iwata, AAII, Musashino University.
1:15 – 1:45 pm	**Art Sensorium Project for Global Cyber Museum: Data Science to Realize Art Experiences with Integrated Art Collections** Prof. Naoki Ishibshi, AAII, Musashino University.
1:45 – 2:15 pm	**Optimizing Geophysical Techniques for Archaeological Risk Assessment and Conservation: A Case Study of Qaitbay Citadel, Alexandria** Prof. Abbas Mohamed, Professor of Applied and Environmental Geophysics, NRIAG.
2:15 – 2:40 pm	**Documentary screening:** ***Qaitbay Fort: An Immersive Walk-through Journey***
2:40 – 2:55 pm	**Panel Discussion:** **The Future of Egypt-Japan Scientific Collaboration in Digital Humanities**
2:55 – 3:00 pm	**Closing Remarks**

Abstracts

Art Sensorium Project for Global Cyber Museum: Data Science to realize Art Experiences with Integrated Art Collections

Naoki Ishibashi

Professor at the Faculty of Data Science, Musashino University. President of Governance Design Laboratory, Inc. He holds a Ph.D. in Media and Governance, Keio University (2004). In 2005, he established Governance Design Laboratory, Inc. Since then, he has launched and managed the CO2free.jp Project, the Mamenergy Project, and other projects to promote renewable energy. In 2006, he became a lecturer at Komazawa University, in the Faculty of Global Media Studies.

He served as the Artizon Museum IT Project Leader in 2017, where he managed the IT strategy for the new museum in both its hardware and software aspects, and designed and built the Artizon Cloud, the core system for the new museum. In 2020, he became a professor in the Faculty of Data Science at Musashino University, where he is engaged in research and development of database systems, multi-database systems, and multimedia systems. He is a member of IEEE, ACM, the Information Processing Society of Japan, and the Japanese Database Society.

Abstract

In the realm of virtual experiences for art, the Art Sensorium Project, established at the Asia AI Institute of Musashino University, emerges as a pioneering endeavor. The project's primary objective is to design and implement a comprehensive system architecture that facilitates the unified management and presentation of art collections within the virtual art experience domain.

To achieve this, the project employs a projection-based Virtual Reality (VR) system, aptly named Data Sensorium. This system enables the staging of art materials in a realistic virtual environment, providing immersive and interactive art experiences.

Furthermore, the project presents a novel system architecture known as Extensible Dynamic Art Museum (EDAM). EDAM is designed to register and disseminate both human-crafted and algorithmic-generated curations, as well as staging environments. Additionally, EDAM offers an intuitive user interface that automates the creation of virtual art museums.

Data science holds immense potential in the art domain, offering the ability to unveil the profound intricacies of art and the profound emotional and exhilarating experiences it evokes in visitors.

Cyber-physical Archeology in Data Sensorium

Hiroo Iwata

Hiroo Iwata is an emeritus professor of the University of Tsukuba, where he led research projects on virtual reality. He is currently a professor at Musashino University. His research interests include haptic interfaces, locomotion interfaces, spatially immersive displays, and motion base. He received his B.S., M.S., and Ph.D. degrees in engineering from the University of Tokyo in 1981, 1983, and 1986, respectively. He was the president of the Virtual Reality Society of Japan from 2016 to 2019. He exhibited his work at the Emerging Technologies venue at SIGGRAPH every year from 1994 to 2007, as well as Ars Electronica Festival 1996, 1997, 1999, and 2001. He served as the general chair of the World Haptics Conference 2007 as well as Asia Haptics 2014. He was awarded the IEEE VGTC VR Lifetime Achievement Award in 2024 and is a member of the IEEE VGTC Virtual Reality Academy.

Abstract

"Data Sensorium" is a conceptual framework of systems providing a physical experience of content stored in a database. As an application of Data Sensorium, we proposed cyber-physical archeology, carried out in collaboration with Musahino University and the Ministry of Tourism and Antiquities, Egypt. Digitized cultural heritage is a new frontier in archeology. We proposed a real-sized walkable 3D model of cultural heritage based on Data Sensorium technology. The 3D model is captured by LiDAR sensor used in real cultural heritage. It was visualized on the spatial immersive display at real size, and participants could physically walk around it using a locomotion interface.

Immersive Qaitbay Fort Legacy: From Sultanate Glory to Virtual Space

Mohamed Soliman

Mohamed Soliman holds a Ph.D. in archaeological architecture. He is A visiting academic researcher at both the Asia AI Institute (AAII) at Musashino University and the Art Research Center (ARC) at Ritsumeikan University. An expert member of ICOMOS and an expert for the European Commission, his work bridges governmental heritage management with advanced global research networks spanning Japan, the USA, and Europe.

As a specialist in archaeological architecture, he conducted his Ph.D. thesis on the intricate water systems of medieval Alexandria. Dr. Soliman's current research focuses on the sustainability and resilience of cultural heritage. He utilizes an interdisciplinary approach that leverages cutting-edge technologies—including Artificial Intelligence (AI), GIS, and digital twins—to protect vulnerable coastal heritage from climate and disaster risks.

Abstract

Interpreting multi-layered heritage sites requires a transition from static 3D models to immersive, interactive environments. This research examines the virtual presentation of Qaitbay Fort in Alexandria, an "inherited heritage" constructed in 1479 on the ruins of the Pharos Lighthouse (one of the Seven Wonders of the Ancient World) constructed by Ptolemy II Philadelphus (3rd century BC) using its authentic stones. In this environment, physical site data and virtual historical layers coexist with AI-generated storytelling presented by avatar iconic figures that influenced the timeline of Qaitbay Fort and Alexandria.

By utilizing Data-Sensorium technology, developed at Musashino University, we have unlocked a portal where technical accuracy meets human emotion. Grounded in Prof. Iwata's 7D Design Framework, the methodology maps raw LiDAR data directly to human behavior, transforming a cold digital twin into a deeply performative space.

As users step into this cyber-architecture environment, the boundaries of time dissolve. They are instantly swept into a synchronized, multi-modal narrative that spans centuries—journeying seamlessly from the Dawn of Alexandria in the 4th century BCE to its 19th-century Renaissance. Along the way, the fort's tangible stones melt into intangible legacies. AI-driven 3D avatars of the iconic figures who shaped the city's fate emerge from the shadows, utilizing voice synthesis and spatial soundtracks to whisper archival histories directly to the traveler.

Ultimately, this work delivers a scalable roadmap for "Heritage 4.0", proving that when artificial intelligence meets rigorous digital architecture, we do not just protect history—we let it speak.

Optimizing Geophysical Techniques for Archaeological Risk Assessment and Conservation: A Case Study of Qaitbay Citadel, Alexandria

Abbas Mohamed Abbas

Head of the Applied Geophysics Department at the National Research Institute of Astronomy and Geophysics (NRIAG) in Cairo, Egypt. Dr. Abbas holds a Ph.D. supported by the DAAD and completed a postdoctoral fellowship funded by the JSPS. An active member of international organizations including the SEG, IUGG, EGS, and IGA, Dr. Abbas brings decades of expertise to geotechnical assessments, groundwater exploration, utility detection, and infrastructure development. His core competencies include archaeogeophysics, hydrogeophysics, digital signal processing (DSP), and operating advanced instrumentation such as Ground Penetrating Radar (GPR) and resistivity imaging systems. Currently, Dr. Abbas leads high-profile research combining cutting-edge geophysics and AI with heritage preservation. His key projects include investigating internal voids within the Great Pyramid of Giza, exploring Tutankhamun's tomb in Luxor, and reconstructing the structural architecture of the Hawara Pyramid.

Abstract

The long-term preservation of archaeological monuments requires a comprehensive understanding of subsurface geological conditions that may compromise their structural stability. This study presents an integrated geophysical investigation conducted at the historic **Qaitbay Citadel**, Alexandria, Egypt, to assess the condition of the mother rock and identify potential geotechnical hazards affecting the monument. The investigation employed two complementary non-invasive geophysical techniques: **Ground Penetrating Radar (GPR)** and **Electrical Resistivity Tomography (ERT)**. GPR surveys were carried out to detect shallow subsurface discontinuities, fractures, weathered zones, and potential cavities with high spatial resolution, while ERT profiles were used to characterize deeper lithological variations, determine the degree of rock weathering, and identify moisture infiltration pathways and zones of reduced resistivity associated with structural weakness. The integration of both datasets enabled a comprehensive assessment of the limestone foundation beneath the citadel and improved the reliability of subsurface interpretation compared with the application of a single method. The results revealed variations in the quality of the mother rock, including fractured and weathered zones that may represent potential risks to the structural integrity of the monument. Correlation between the GPR reflections and resistivity anomalies provided valuable insight into the geometry and extent of these features, supporting a more accurate evaluation of subsurface conditions. The study demonstrates that the combined use of GPR and ERT is an effective, rapid, and non-destructive approach for archaeological risk assessment and conservation planning. The findings contribute to the development of evidence-based conservation strategies and highlight the importance of integrated geophysical investigations in safeguarding cultural heritage sites exposed to environmental deterioration and geotechnical instability.