CASE STUDY
Rajamangala University of Technology Suvarnabhumi
Utilizing Advanced Digital Engineering Technologies for Archeological Preservation.

Photo Credit: Mongkol Kaewbumrung

Background

Phra Nakhon Si Ayutthaya in Thailand, a UNESCO World Heritage Site, represents the rich legacy of Thai art and culture. Preserving the ancient ruins and murals scattered across the region has become a challenge due to the risk of deterioration from environmental factors. A team of researchers led by Dr. Mongkol Kaewbumrung from the Rajamangala University of Technology Suvarnabhumi were planning to develop a robust digital preservation system that accurately captures these invaluable cultural assets assisting their long-term preservation.

A collaboration between the university and CYBERNET enabled them to leverage the latest Ansys Computational Fluid Dynamics (CFD) simulation technologies and CYBERNET CAE Cloud service leading to significant results in their efforts.

"Implementing the CYBERNET solution led to significant results in our preservation efforts. By utilizing advanced technologies, such as Ansys Fluent Meshing and CYBERNET CAE Cloud, we were able to accurately model and analyze the environmental conditions affecting the ancient mural paintings."

Mongkol Kaewbumrung Ph.D.
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มหาวิทยาลัยเทคโนโลยีราชมงคลสุวรรณภูมิ
Rajamangala University of Technology Suvarnabhumi

Rajamangala University of Technology Suvarnabhumi (RUS), is one of the significant centers of education for science and technology in the central region of Thailand. It was renamed as a government university on January 18, 2005, and supervised by Commission on Higher Education, Ministry of Education. The university comprises four campuses in three provinces.

The Challenge

The ancient mural paintings face a high risk of deterioration due to environmental factors such as humidity, temperature fluctuations, and air pollution. Traditional preservation methods were inadequate to address the complexity of these issues, especially when it came to predicting and mitigating the long-term impact of environmental changes on these fragile artworks.

Ratchaburana Historical Temple, Ayutthaya Historical Park, Thailand. Cover image depicts ancient murals in Crypt No.3.

They had to ensure that their preservation efforts would not alter or damage the murals' original integrity.

The scale of the analysis grew due to the detailed modeling, and their existing computational resources were insufficient to support the process.
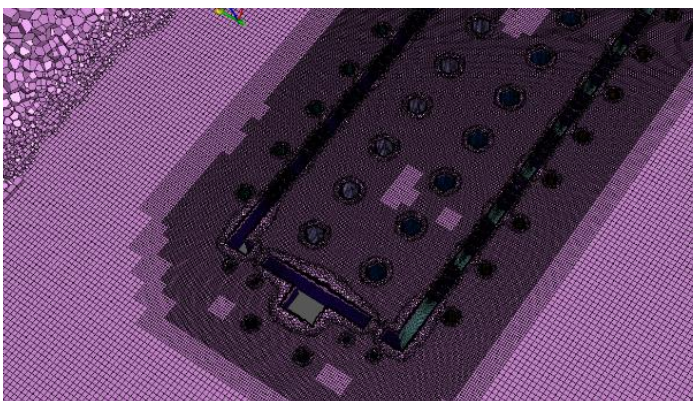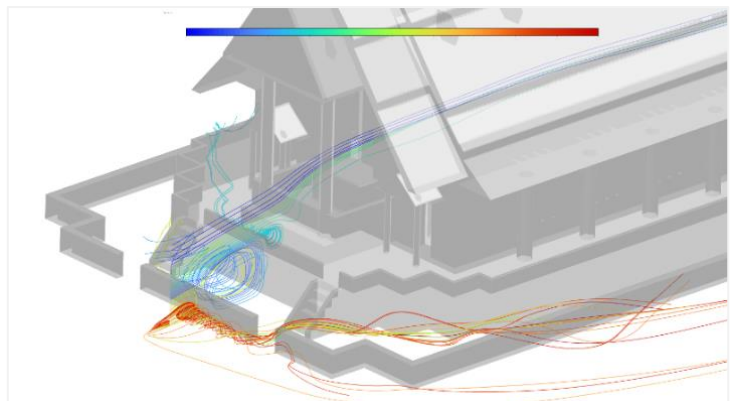

Right: Na Phramen Temple, Ayutthaya.

CYBERNET Solution

- Ansys Academic Research CFD
- Ansys HPC Pack
- CYBERNET CAE Cloud

Advanced digital engineering technologies such as Mosaic meshing in Ansys Fluent fluid simulation software, enabled the researchers to accurately model and analyze environmental conditions affecting the murals. This approach led them to identify potential risks and implement targeted preservation strategies significantly reducing the deterioration rate of the murals.

A model of Na Phramen Temple simulated with Mosaic Meshing.

Computational Fluid Dynamics results for Na Phramen Temple.

The creation of detailed 3D models provided a comprehensive digital archive, ensuring that the current state of the murals is meticulously documented and preserved. This archive not only serves as a safeguard against further deterioration but it's also a valuable resource for future research and restoration efforts.

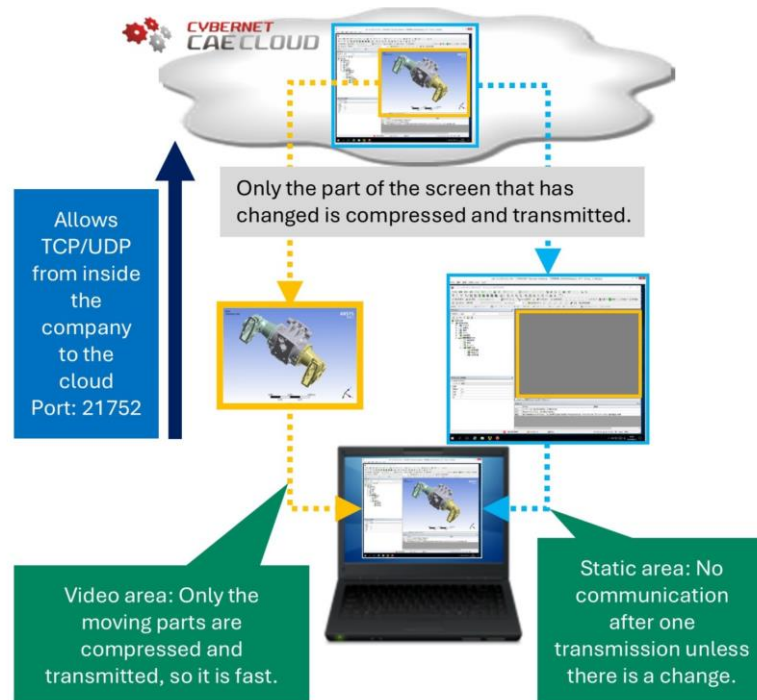## CYBERNET SYSTEMS MALAYSIA SDN. BHD.

The CYBERNET CAE Cloud is hosted on AWS in Tokyo. Typically, when accessing a server in Tokyo from Thailand, delays can occur causing slow screen transitions making it nearly unusable. However, the high-speed remote desktop function minimizes these delays, allowing remote users to work efficiently without any significant lag.

CYBERNET CAE Cloud web-based UI

Distinct features of CYBERNET CAE Cloud enabled faster and smooth remote access for the research team working from over 4300km away.

CYBERNET CAE Cloud

CYBERNET CAE Cloud offers flexible specifications (e.g., number of CPU cores, memory capacity, and storage) through AWS EC2[*1], and the configuration is simple. Even for those who are new to cloud computing, they can easily create and manage servers with a few mouse clicks using its web-based, user-friendly, intuitive GUI. The servers come with pre-installed Ansys software, so, the setup takes only about 10 minutes.

CYBERNET CAE Cloud, allows you to conduct large-scale analyses when you can't rely on your on-premise resources alone.

[*1] **Amazon EC2 service**
Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides secure, resizable computing capacity in the cloud. It is designed to make web-scale cloud computing easy for developers.

"CYBERNET CAE Cloud service provided by CYBERNET Japan, allowed us to access computational power as needed, whenever we needed it. We implemented this solution with localized support from CYBERNET Malaysia team. With the CYBERNET CAE Cloud, we were able to conduct large-scale analyses that were previously unattainable with our on-premise resources alone"

Dr. Mongkol Kaewbumrung

CYBERNET SYSTEMS MALAYSIA SDN. BHD.

Sustainability

The preservation work in Ayutthaya is aligned with the United Nations' Sustainable Development Goals (SDGs), specifically, SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action). Researchers' commitment to sustainable practices further boosted their credibility and influence in the global heritage conservation community.

As a leading technology company and a responsible corporate citizen, CYBERNET is committed to leveraging technology to develop solutions that have a positive impact on both the environment and society. More details on: Sustainability | CYBERNET

Future Goals

"We aim to enhance our digital preservation efforts to safeguard cultural heritage sites for the long term. Building on current successes, we plan to integrate AI-driven predictive modeling and real-time environmental monitoring to better address threats like climate change and urban development."

"By collaborating with technology partners such as CYBERNET, international organizations, and research institutions, we seek to build a global network for preservation. We are also committed to training local communities to actively participate in protecting their cultural heritage."

Dr. Mongkol Kaewbumrung

Conclusion

By using Ansys engineering simulation software and CYBERNET CAE Cloud services, Dr. Kaewbumrung and his team were able to accurately simulate the environmental factors that cause the decay of ancient murals, predict long-term risks, and implement more effective preservation strategies. They met their goals by setting a new standard for archeological preservation, not only in Thailand but also globally.

About CYBERNET

CYBERNET SYSTEMS MALAYSIA SDN.BHD. supports customers in Malaysia, Singapore, Thailand, Vietnam, and other ASEAN countries. They provide a wide variety of software, technical support, engineering services and training in areas such as Computer-Aided Engineering (CAE), Vehicle Simulation, Casting Simulation, Tolerance Analysis, and Digital Engineering solutions that combine CAE with emerging technologies for Digital Transformation, such as IoT, AR-VR, Digital Twin, Big Data analysis, and AI.

CYBERNET MALAYSIA is a wholly-owned subsidiary of CYBERNET SYSTEMS CO., LTD., headquartered in Tokyo, Japan, a leading CAE company established in 1985.