

# Building of Digital Archives of Kyrgyz Museums: Preserving the Cultural Resources of Kyrgyzstan

Hanhee Hahm<sup>1</sup>, Semina Oh<sup>1</sup>, Minhee Choi<sup>1</sup> and Soon Cheol Park<sup>1</sup> +

<sup>1</sup> Jeonbuk National University, Korea

**Abstract.** The cultural resources of Kyrgyzstan are extensive and diverse, comprising a vast collection of historical, artistic, and scientific artifacts. Unfortunately, many of these priceless treasures are housed in museums that are facing a shortage of resources and support, making them susceptible to damage and loss. To tackle this challenge, the Building Digital Archives of Kyrgyz Museums project was established to create a centralized digital repository of the nation's cultural resources. This paper discusses the processes and technologies employed in developing the digital archives, which include effective data management and the creation of a user-friendly interface. The project has had a significant impact on preserving and sharing Kyrgyz cultural resources both locally and globally. By ensuring that these valuable assets are accessible to the public, the project has contributed to the promotion and appreciation of Kyrgyzstan's rich history and culture.

**Keywords:** Digital Archives, Kyrgyz Museum, Meta Data, Cultural Resources.

## 1. Introduction

Kyrgyzstan, a landlocked country in Central Asia, is renowned for its rich and diverse cultural heritage [1]. The nation is home to a multitude of museums housing invaluable and distinctive artifacts that chronicle the history, art, and culture of Kyrgyzstan. However, despite their significance, many of these museums face resource constraints, including limited funding and staff, thereby exposing the cultural resources of the country to the risks of loss and degradation [2].

In response to these challenges, Kyrgyzstan Cultural Resource Management System (KCRMS) has been developed. This system serves as an integrated platform for the collection and management of data related to Kyrgyzstan's cultural resources, with the primary objective of efficiently storing and retrieving information from various museums and galleries nationwide.

The development of KCRMS took into consideration the economic aspect and utilized open-source technologies such as Linux, Apache, MariaDB, and PHP/Java, tailored for optimal performance in a web environment [3]. The data structure and representation of the system adhere to the Dublin Core metadata standard, emphasizing shareability and portability, while employing a relational database system for efficient data storage and management [4]. Notably, the system design incorporates direct collaboration with museum curators to ensure that it reflects the characteristics of Kyrgyzstan's cultural resources.

This paper provides an overview of the KCRMS system and the digital archive project, emphasizing their significant role in the preservation and promotion of Kyrgyzstan's cultural resources.

## 2. Current State of Cultural Heritage Preservation in Kyrgyzstan

Despite having an abundance of cultural treasures, such as unique artifacts, manuscripts, and historical documents housed in its museums, Kyrgyzstan often faces risks of losing these valuable assets due to inadequate storage facilities, insufficient funding, and the threat of natural disasters and human interference. The inadequate preservation of cultural assets may result in the loss of crucial cultural treasures, which would be a significant damage for both the people of Kyrgyzstan and the world at large.

The project focuses on three museums in Kyrgyzstan: National Museum of History, National Museum of Fine Arts, and Nomad Museum, all situated in central tourist or administrative areas [5]. Currently, these

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+ Corresponding author. Tel.: + 82 10 9590 2467; fax: +82 63 277 4098  
E-mail address: scpark@chonbuk.ac.kr

museums have different archival data formats that require consolidation. Some computerization efforts have been made with the assistance of the international funds. However, they still rely on manual artifact/work listings and face challenges due to inconvenient modifications and poor electricity conditions. For examples, the digital records are only stored on hard disks, not databased, and new data are not digitized any more. The current status of cultural resources held in the three museums in Kyrgyzstan are shown in Table 1.

Table 1: Current status of cultural resources held in the three museums

	NHM		FAM		NOMAD	
Type	No. of Raw Data	No. of Digital Data	No. of Raw Data	No. of Digital Data	No. of Raw Data	No. of Digital Data
Archaeology	11,550	3			302	26
History	41188					02
Art	45,722		15,253	2,200	3	
Ethnographic data	9,089		2,672		280	178
Total	107,557	3	17,825	2,200	585	306

### 3. Building a Digital Archives System

#### 3.1. The KCRMS System

To develop and effectively implement digital archives in Kyrgyz museums, the following recommendations are proposed [6]:

- **Technology selection:** The selection of appropriate technology for the creation and maintenance of digital archives is crucial to their success. This includes hardware, software, and data storage solutions.
- **Data management:** Proper data management is essential to ensure the long-term sustainability of digital archives. This encompasses the establishment of metadata standards, data preservation strategies, and backup and disaster recovery plans.
- **User accessibility:** Digital archives must be user-friendly and easily accessible to maximize their benefits. This includes the development of intuitive interfaces and the use of suitable technologies for information retrieval.
- **Ongoing maintenance:** Continuous maintenance is critical to ensure the long-term viability of digital archives. This involves regular updates, backups, and the integration of new technologies as they become available.
- **Collaboration between museums:** Collaborating with other museums is crucial for the success of digital archives. This entails the sharing of resources, expertise, and the development of common standards and protocols.

From the functional perspective of KCRMS, the structure is designed to collect and manage data efficiently and effectively. To achieve this goal, it is crucial to understand the expression and structure of the data that meets the needs of the users. Two benchmark systems are utilized to implement the system smoothly, such as Europeana [7] and Myanmar's Cultural Resources Management System (MCRMS) [8]. Europeana archives cultural materials from around 3,000 museums and galleries in Europe and adheres to the Dublin Core for data structure and presentation on the web. On the other hand, MCRMS is user-friendly and has the advantage of displaying the location of data on a map. The development design of the KCRM system incorporates insights from these two systems.

Given the current inadequate digitized cultural resource management conditions and the shortage of trained IT technicians in museums, we propose the sustainable digital management system of cultural resource in the three museums including easy software and improved hardware environments accompanied by the use of a cloud system as the server of the system.

#### 3.2. Software Environment

The system is developed in an open-source (Linux CentOS7, Apache 2.4.5, MariaDB 5.5.64, PHP/JAVA) environment. The development software is periodically upgraded and is stable, optimized for most computer

models, and cost-effective. The structure of the development system is optimized for the web environment and is shown in Fig. 1.

The system is based on the structure of MCRMS, utilizing the Europeana as a reference. The system has three basic ways to access data - desktop computers, mobile devices, and kiosks - with the actual implementation to be determined according to the requirements of each museum.

In Fig.1, Data Access Layer is managed by accessing MariaDB through the JDBC API on the Linux operating system. MariaDB is the database system that stores all the data and data structures of the system [9]. Business Logic Layer manages program modules for the four major system functions: Inventory, Story, Events, and Statistics. Presentation Layer helps users perform system functions easily and reliably and allows them to display desired results on the web.

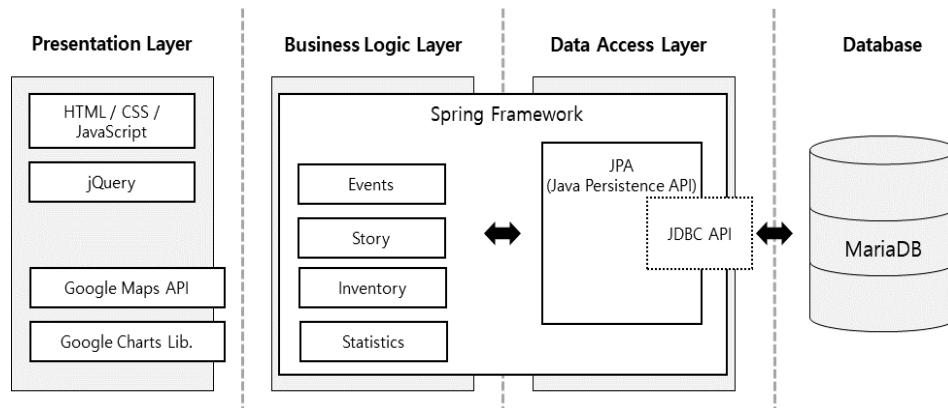


Fig. 1: System software structure of KCRMS

### 3.3. Hardware Environment

The hardware configuration uses a private cloud computing environment based on IaaS (e.g., Amazon Web Services) [10]. The cloud servers have the advantage of low maintenance costs after system development.

Table 2 shows the specifications of the system for the IaaS-based cloud computing environment of AWS. In order to enhance security, we installed a secure zone firewall that prevents unauthorized access to any data beyond what can be opened at the source. Additionally, we considered the number of concurrent users, ensuring that enough users can access the permitted data simultaneously.

Table 2: The specifications of the KCRMS cloud computing environment

	Environment
Cloud Computing	<ul style="list-style-type: none"> <li>• Server type: EC2 r5a.large type, vCPU (2cores), 16 GB memory</li> <li>• Number of servers: 1</li> <li>• Data Storage: gp2 type, 2TB SSD + 20TB HDD (backup)</li> </ul>
Network equipment and capacity	<ul style="list-style-type: none"> <li>• Public IP: 1</li> <li>• Network Usage: 100 GB</li> </ul>
firewall	<ul style="list-style-type: none"> <li>• Secure Zone Firewall (Type: Standard)</li> </ul>
No. of concurrent users	<ul style="list-style-type: none"> <li>• Approx. 1000 people</li> </ul>

### 3.4. Basic DB Design

The database system uses a relational database system (MariaDB) with tables as the underlying data structure, with artwork or objects being the main data to be collected. To ensure effective data management, the proposed Dublin Core metadata standard for objects is included, and artist opinions are sought to reflect in the design.

In order to construct the database, certain metadata elements were chosen for consideration and were initially reviewed through employee assignments from three museums. A total of 26 elements were utilized and integrated into the database design. These elements were classified into four primary categories, namely: basic resource information, raw data information, information regarding the institutions or individuals who

contributed cultural resources, and resource management information, such as uploading and location details for materials. The specifics of these categories can be observed in Table 3.

Table 3: Metadata elements of KCRMS

Information groups	Attributes	
	Name	Description
Basic information	Title	The name given to the resource.
	Description	Description of the contents of the resource
	Institution ID	Museum-managed ID
	Providing Institution	The organization that provided the data
	Data type	Uploaded data type
	ID	Identifier
Raw Data Information	Object type	The nature or genre of the contents of the resource
	Object size	Object size
	Object material	Object material
	Temporal	When the resource was created
	Current location	Current resource location
	Coverage	The quantity or extent of the contents of the resource
Provision and management information	Creator	An entity that has primary responsibility for creating the contents of a resource
	Publisher	The object responsible for making resources available
	Provider	The object that provided the resource
	Collection name	Resource gathering organization
	Source	Source which the current resource is derived from
	Rights	Information about the rights or rights to resources
	Rights statement	Rights statement for the media in this item (unless otherwise specified)
Uploading time and location information	File upload	File upload window
	Timestamp created	Automatic system record
	Timestamp updated	Automatic system record
	Latitude	
	Longitude	

### 3.5. Implemented system

The system has been designed with a focus on simplicity and ease of use for uploading and accessing data. Its usage system is intuitive, thereby minimizing the need for a user manual. Kyrgyz users were actively engaged throughout the development and management phases. In accordance with user and developer agreements, the number of metadata elements was reduced from an initial setup of 58 to 26. The identifier for items in the main database table is automatically generated based on basic user input information. The metadata is user-friendly and includes titles and descriptions in Kyrgyz, English, and Russian that are formatted in accordance with National Museum of History guidelines.

The system can be operated on desktops or mobile devices, and the user interface web pages have been developed with responsive web design (RWD). The web pages of the system include a home screen and other relevant screens. The following are the functions and descriptions of the screens.

- Home screen: The home of the KCRMS features a randomly chosen image and a brief description of the three Kyrgyz museums. Users can register and log in to their memberships through the website. The bottom of the screen displays contact information and allows users to select and view the homepage menu in Russian, Kyrgyz, or English. The home page of KCRMS is shown as in Fig. 2.

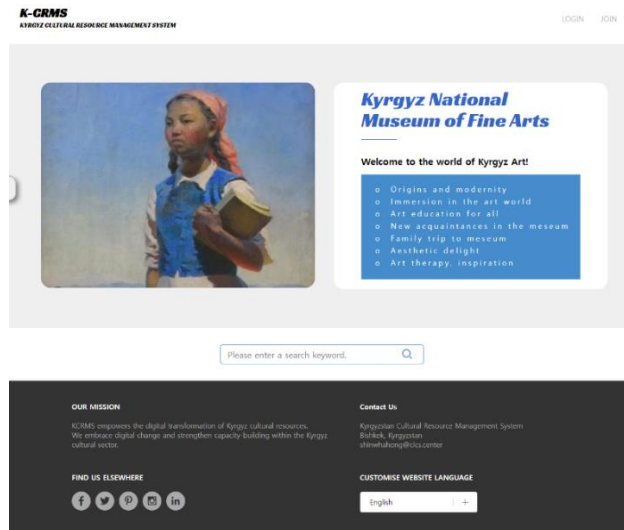


Fig. 2: Home page of KCRMS

- Search result list screen: One can search for keywords in the search box on the homepage or on the list screen. The results are displayed in two types of lists: one is a card-view layout and the other is a list-view layout.
- Detail screen: After retrieving search results, the detail screen shows two sections: metadata and a map. The metadata section displays information about the retrieved data, while the map section shows the location of the data stored on Google Maps. The map function utilizes the Google API.
- Data upload and correction screen: The system allows for the input and alteration of information related to digital multimedia data and metadata.
- Join and register screen: Access to data is limited until signing up. One can obtain permission to access data by going through the Join and Register screens.
- Manager screen: The system manager uses this screen to manage the system and all related functions, such as membership registration, membership information modification, data management and modification, system error management, and more.
- Statistic screen: The statistics for institutional data are displayed on this screen.

Data input statistics as of May 8, 2023 indicate that a total of 4162 data items have been uploaded by the three museums as shown in Fig. 3.

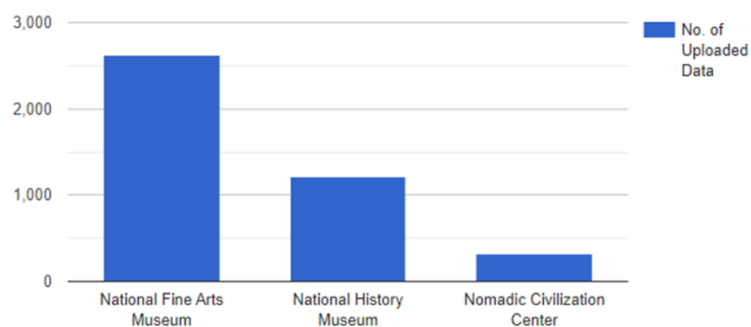


Fig. 3: Statistics of Data uploaded by the three museums

## 4. Conclusion

The implementation of the Building of Digital Archives of Kyrgyz Museums project marks a significant advancement in safeguarding and sharing Kyrgyz cultural resources. Through the establishment of a centralized digital repository and platform, this initiative has effectively secured the enduring preservation and

availability of Kyrgyzstan's historical and cultural heritage. The digital archives have garnered favorable responses both domestically and internationally, fostering a deeper comprehension and admiration for Kyrgyz cultural resources.

Conclusively, digital archives offer a practical solution to the challenges confronting cultural resource preservation in Kyrgyzstan. By digitally replicating artifacts, manuscripts, and historical documents, these invaluable cultural assets can be stored securely and made easily accessible. The support of the Building of Digital Archives project plays a pivotal role in facilitating the development of digital archives within Kyrgyz museums, ensuring the conservation of the nation's abundant cultural resources for future generations. This investment in Kyrgyzstan's cultural heritage will yield enduring benefits for the people of Kyrgyzstan and the global community as a whole.

## 5. Acknowledgements

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## 6. References

- [1] K.Imanaliev. *The Kyrgyz (the Word of Homeland)*, trans. by L.A. Philippova. 2018.
- [2] H. Hahm, et al. A Feasibility Study of ‘the Constructing Digital Cultural Resources Management System and Capacity-building for Cultural Contents Creation in the Kyrgyz Republic, submitted by CICS to Asia Culture Center annual report, 2021. 12.
- [3] [https://en.wikipedia.org/wiki/LAMP\\_\(software\\_bundle\)](https://en.wikipedia.org/wiki/LAMP_(software_bundle)), accessed May 8, 2023.
- [4] The Dublin Core is a metadata element set which is a general-purpose scheme for resource description of the information objects on the Web. Dublin Core website: <https://www.dublincore.org/>, accessed May 8, 2023
- [5] [www.museum.kg](http://www.museum.kg); [www.artmuseum.kg](http://www.artmuseum.kg); <https://nomadmuseum.art/>, accessed May 8, 2023
- [6] S.C. Park, et al. *Digital Archives for Humanities Scholars*. Minsokwon, 2018
- [7] <https://www.europeana.eu/en>, accessed May 8, 2023.
- [8] S.C. Park, S. Hong, K. Oh, H. Hahm. A Study of Background and Meaning of the Establishment of Myanmar Cultural Heritage Management System – A Case Study of Cultural ODA-, *Intangible Heritage Studies 2021*, 6 (2): 123-146.
- [9] <https://en.wikipedia.org/wiki/MariaDB>, accessed May 8, 2023.
- [10] <https://www.ibm.com/topics/iaas-paas-saas>, accessed May 8, 2023.