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Model Of Storing Movement Data In The Intangible Cultural Heritage To Develop Living Digital Archives

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Abstract – Living digital archives are collections of information from various sources and periods, through the design and development of new systems that integrate all the content of the information in the database system. This paper highlighted the storing of movement data in the intangible cultural heritage to develop living digital archives. The study is qualitative from document studies, in-depth interviews, and quantitative questionnaires to data. In this way, the movement data in the intangible cultural heritage in the model of living digital archives including corporate infrastructure, information resource management, and technology and security. Meanwhile, the significance of living digital archives of authentication login, database system, and web application. In addition, the efficiency of living digital archives web application of functional requirement testing, functional testing, usability testing, performance, and security to a high level. Satisfaction with the use of living digital archives is high level. Also, the living digital archives web application results in the collection of cultural heritage movement data with motion techniques in the form of a 3D coordinate system for an effective data set.
Keywords – Storing movement data, Intangible cultural heritage, Living digital archives.

1. INTRODUCTION

The concept of storing and accessing mobility data for a living digital archive changes the term "Digital Archive" to "Living Archive" to indicate the storage of data with special characteristics, and specificity in the field of storing cultural heritage movement data using motion capture techniques, a metadata corresponding to the transformation of the model for storing movement data is described, and the information is made public, e.g., Hong Kong Martial Arts Living Archive: HKMALA. There will be a presentation of the museum exhibition of computational science, models, and systems thinking for embedded cultural heritage and digital heritage [1]. Digital dance ethnography research is the management of large datasets for folk dance. Analysis of movement data to organize dance data into classification diagrams. In addition, datasets are described in metadata related to intellectual cultural heritage, and stored in the database schema, specifically, summarizing dance data organized into data structures, creating relationships of primary and secondary data representing different tree structures, as well as, visualizing the evolution of the dance over time. Includes a demonstration of retrieving information on similar dances according to context from a database [2]. Challenges regarding storing cultural heritage movement information are also discussed. Motion capture and its application to modern media include issues relating to intellectual property management and copyright law [3]. They are prototyping digital cultural heritage using new processes and innovations [4]. Specifically, data management, metadata schema design, and database design to support storage and access of information through digital archives by modern media such as AR, VR, MR, etc, in an interactive learning environment.

Wherein the research studies in Thailand, a moving dataset of cultural heritage has been produced using motion capture, including, the application of motion capture in preserving Thai sword art [5], the developing multimedia for hearing-impaired children in Reum An-re, a famous folk dancing of Surin province [6], the development of 3D animations for practicing basic Thai boxing moves [7], and entertainment education media for martial arts and Thai boxing using motion capture techniques [8]. However, these data are not yet stored in a living digital archive, which makes them effectively inaccessible.

Therefore, good practices regarding the recording of movement data that are intangible cultural heritage, storing and accessing the information on living digital archives, and presenting guidelines for capturing movements of

intangible cultural heritage according to the project named archive as Hong Kong Martial Arts Living Archive: HKMALA [9], and folk dance movement capture database project, data collection on a digital archive that can access a wide range of data, such as text, audio, images, video, 3D models, and motion capture data, and design metadata schema, digital display of intangible cultural heritage [10]. This research has the following main objectives to analyze the movement data in the intangible cultural heritage in the model of living digital archives, develop living digital archives, and study satisfaction with the use of living digital archives as are process of movement data storage for living digital archives, cost-effectively allocating existing resources, and appropriate to the context and situation, planning the development of a new system to effectiveness.

2. The storing movement data in the intangible cultural heritage using motion capture.

The performing arts branch for Thailand's intangible cultural heritage is 1 of the 7 branches of Thai cultural heritage. According to the Act on promotion and preservation of cultural intellectual heritage [11],[12]. So, Thai classical dance is a science that is consistent with the principles of perennial philosophy, with emphasis on the teacher as important, where all knowledge comes from the teacher because dance is the transmission of knowledge inherited culturally from the individual rather than various textbooks that have patterns, and rules called "Traditional dance" [13], [14]. For this reason, transferring and preserving knowledge in the performing arts demonstrates individual ideas and wisdom in creating works, and promoting it as a valuable heritage [15]. The transfer of knowledge about dance shows individual ideas and wisdom in creating works. It should be preserved, inherited, and promoted as a valuable heritage. Preserving and storing movement data of intangible cultural heritage using motion capture techniques a method for scanning Lasky dance data, using motion capture techniques through an optical motion capture system is presented. The resulting movement biomechanics for dance sequences can be applied to dance involving the upper and lower parts of the body, including hand movements [16]. The digitization of Dunhuang dance data using motion capture technology provides data support for further research, protection, and future use of Dunhuang dance resources that can be applied to other dance fields [17]. Developing a framework for preserving the local cultural heritage of Silat Gayong, using motion capture as a motion capture tool.

Developing and presenting a new framework for conservation is the practice of applying motion capture equipment that generates knowledge, providing a structure that links the investigations into each step of the framework, where these steps include specific roles of activities, the objective, and the concept of using a robust motion capture framework to capture intangible cultural movements is an important aspect of the digital conservation, considering the available metadata structure, semantic information, digital storage for future reference [18]. Digital archives standards should include links and interchangeability. Therefore, guidelines for the management of digital cultural heritage resources that can be formatted by international metadata standards, and which can be used by organizations that care for all forms of art, would expand the scope, creating cultural knowledge effectively [19]. The main elements that are important in developing movement data storage standards for living digital archives are, a) standards for producing motion datasets from consideration of elements for producing motion datasets, such as the selection process for actors with motion expertise, the availability of personnel and motion capture equipment, select the data files used for storage, and so on [20]. In addition, consider the elements for dissemination, and use them in education and research for use in considering hosting data on a living digital archive, b) data warehouse management standards consideration of the elements of the digital library standard consists of 3 elements and 16 basic requirements such as 1) organization infrastructure including mission and scope, licenses, continuity of access, confidentiality and ethics, organizational infrastructure expert guidance, 2) digital object management including integrity, authenticity, appraisal, document storage procedures, preservation plan, data quality, workflows, data discovery and identification, data reuse, 3) technology including technical infrastructure, and security.

3. The CoreTrustSeal

The CoreTrustSeal [21],[22], [12], to development of digital archives using standards CoreTrustSeal in this study, c) standards for organizing, and documenting knowledge sets considerations for the elements of functional requirements for bibliographic records, or FRBR, including work, is a distinct intellectual or artistic creation. Expression is the specific intellectual or artistic form that a work takes each time it is realized. Manifestation is the physical embodiment of an expression of a work as an entity, manifestation represents all the physical objects that bear the same characteristics, concerning both intellectual content and physical form. Item is a single exemplar of a manifestation. The entity defined as an item is a concrete entity by IFLA [23],[24],[25],[26], in recordkeeping, organizing, and managing knowledge in the form of datasets, are ideas for implementing the functional requirements for bibliographic records, or FRBR, and d) metadata standards based on elements for designing metadata schema, include descriptive metadata, technical metadata, preservation metadata, rights metadata, structural metadata, markup languages, where metadata standards can be selected that are appropriate for the data warehouse context in which they are developed. Store cultural heritage such as MARC, BIBFRAME, MODS, CIDOC CRM, CDWA, VRA Core, and EAD [27]. The design of the metadata schema with the cultural heritage movement datasets [28],[29], [16] into the model of living digital archives compare elements according to standards in CoreTrustSeal with the context of living digital archives on digital information resources, digital museums, motion capture, animation and multimedia, culture and performing arts, digital university library and archives among 3 people, and copyright law. Also, the development of the storing movement data standards in the intangible cultural heritage of living digital archives on collecting data, data processing, and utilization of mobility datasets for living digital archives, model regarding copyright management of information resources, which is an intellectual property agreement, defining the characteristics of knowledge recording according to the FRBR concepts, and metadata schema using the application profiles concepts to effectiveness.

4. METHODOLOGY

A mixed method research adopted to involves both qualitative and quantitative data to combine participatory action learning to multi-contextual and cultural perspectives for the research to complete and provide the explanations and conclusions based on the research results of the study on the storing of movement data in the intangible cultural heritage to develop living digital archives. The spatial studies were taken with key informants of stakeholders in the study and analysis of issues regarding the model of living digital archives, compares elements according in CoreTrustSeal with the context of living digital archives, and inquiries with 3 and 15 experts, they all were by purposive sampling of developing living digital archives, and survey data with 53 volunteers who are undergraduate students, New Media Department, Faculty of Information Science Faculty, Maha Sarakham University, Thailand, they all were by purposive sampling of satisfaction with the use of living digital archives into the methods.

The research tools used for data collection included 1) a semi-structured interview addressed to leading the organization with the movement data in the intangible cultural heritage in the model of living digital archives including corporate infrastructure, information resource management, and technology and security. It consisted of 4 interview topics all concerned questions like - How can the movement data in the intangible cultural heritage in the model of living digital archives? 2) a semi-structured interview addressed to leading the organization with living digital archives of authentication login, database system, and living digital archives web application. It consisted of 3 interview topics all concerned questions like – What are living digital archives? 3) a semi-structured questionnaire on the efficiency of living digital archives web application, and satisfaction with the use of living digital archives. It consisted of 5 rating scales divided into 5 parts and each part addresses questions: part 1; functional requirement testing, part 2; functional testing, part 3; usability testing, part 4; performance, part 5; security. The whole questionnaire included open-ended suggestions with a reliability value of 0.85.

The data collection and equerry methods included document analysis which consisted of synthesizing information from relevant documents and related research for the integration and development of conceptual framework pertaining the participatory action learning, individual in-depth interviews to multi-contextual and cultural perspectives of 3 experts to take the results for analysis of the movement data in the intangible cultural heritage in the model, and living digital archives. Including the survey by questionnaire addressed to 3 experts to take the results for the analysis of the efficiency of living digital archives web application. It found that the efficiency of living digital archives web application of functional requirement testing, functional testing, usability testing,

performance, and security to a high level (Mean of 4.11), and the survey by questionnaire addressed to 53 volunteers who are undergraduate students to take the results for the analysis of the satisfaction with the use of living digital archives. Regarding data analysis, qualitative data of elements and indicators were analyzed by using three main stages as follows: data reduction, data organization, and data interpretation to conclude, and quantitative data were analyzed by descriptive statistics including frequency, percentage, mean, standard deviation, t-test, F-test with LSD.

5. RESULTS

5.1 Model of living digital archives according to CoreTrustSeal with the context of living digital archives.

The model of living digital archives compares elements was found that there are 3 main elements such as 1) corporate infrastructure to 2 sub-elements, 1.1) mission and scope, 1.2) policy with 9 indicators, 2) information resource management to 8 sub-elements, 2.1) sources of information and the authenticity of the data, 2.2) nature of the research/project, 2.3) selection of metadata standards and preparation of metadata schema, 2.4) preparation of work manuals and work diagrams, 2.5) defining data preservation processes and plans, 2.6) creating operational manuals and flowcharts, 2.7) searching and referencing data, 2.8) reusing data, with 10 indicators, and 3) technology and security to 2 sub-elements, 3.1) technology aspect, 3.2) safety aspect, with 7 indicators according to CoreTrustSeal with the context of living digital archives shown in Table 1.

Table 1. The elements, sub-elements, and indicators to standards in CoreTrustSeal.

The elements.	**Sub-elements.**	**Indicators.**	**CoreTrustSeal.**
1. Corporate infrastructure.	1.1 Mission and scope.	• Implement a standard framework for living digital archives, to store movement data leading to the preservation, and dissemination of unique and culturally valuable movement information as appropriate with quality technology. • Operate within the framework of policies, laws, and copyright protection for the works of the university and creators. • Develop a data deposit system, and a data quality review system, and provide services to users to access data, movement datasets, metadata, and digital objects through a digital archive system to continuous life. • Manage based on good governance in budget allocation. And adequate staff to meet the needs of access to living digital archives for students, teachers, officials, and university personnel.	CTS#1 Mission and scope. CTS#2 Rights Management. CTS#3 Continuity of Service CTS#5 Governance & Resources.
	1.2 Policy.	•Certification of generated data, classification of movement data, preservation, archiving/preservation of cultural performing arts data, living digital archive standards in line with ethical norms, and observed regulations. •Application of modern technology to manage valuable data in cultural performing arts. •Mechanism for consulting experts to listen to recommendations in each relevant area to continuously improve the feedback results. •Select and store movement datasets, and knowledge sets, with metadata, using depositor data from thesis/research	CTS#4 Legal & Ethical. CTS#6 Expertise & Guidance.

The elements.	Sub-elements.	Indicators.	CoreTrustSeal.
		projects related to capturing the movement of students, professors, staff, researchers, including university personnel. •Organize training to develop the knowledge, and skills of communities that use the service to gain access to an efficient living digital archive system.	
2. Information resource management.	2.1 Sources of information and the authenticity of the data.	• Verifying evidence showing the origin of the data, if changed/edited data is imported, must specify the version of the data that was changed from the original before storage/ Preserve information until the information is published.	CTS#7 Provenance and authenticity.
	2.2 Nature of the research/project.	•The motion datasets are obtained by collecting data from a set of industry-recognized standard motion detection devices, and the data collection actors are selected to maximize the value of the motion datasets movement from dance in culturally sensitive matters.	CTS#8 Deposit & Appraisal.
	2.3 Selection of metadata standards and preparation of metadata schema	• Standardized data storage, e.g., academic resource centers, university museums, and university archives, etc., by the organization's mission regarding data types, data storage characteristics, data preservation, cataloging information, analysis, and comparison of metadata function types, including metadata types.	CTS#10 Quality Assurance.
	2.4 Preparation of work manuals and work diagrams.	•Evaluation of data from depositors is consistent with quality criteria for selecting data for storage/preservation, and dissemination.	CTS#8 Deposit & Appraisal.
	2.5 Defining data preservation processes and plans.	• Define processes including data import processes, data management processes, data preservation processes, and data dissemination processes as well as set plans for data preservation and future data transfer.	CTS#9 Preservation plan.
	2.6 Creating operational manuals and flowcharts.	•Objectives, scope, definitions, duties and responsibilities, work procedures, and work process diagram.	CTS# 11 Workflows.
	2.7 Searching and referencing data.	•A living digital archive is a storage of media and metadata, retrieval by metadata, and media or semantic retrieval, using ontology.	CTS#12 Discovery and Identification

The elements.	Sub-elements.	Indicators.	CoreTrustSeal.
		•Defining codes to link access to persistent data identifiers, by providing a standard metadata cataloging format. •Having a database that can link to other databases.	
	2.8 Reusing data.	•Other data and metadata that can be used, and guidelines for using motion data files include motion capture data and 3D viewers.	CTS#12 Discovery and Identification
3. Technology and security.	3.1 Technology aspect.	•Technology and data input processes include data output from industrial motion capture technology, e.g., optical motion capture systems (Optical mocap), and electromagnetic motion capture systems (Inertial mocap), etc. •Technology with the process of data management, and data preservation, including server computers and internet networks, digital inventory software that can store data, and connections to other database networks that can support changes in technology. •Technology and the information dissemination process.	CTS#14Storage &Integrity. CTS#15Technical Infrastructure
	3.2 Safety aspect.	•Managing rights for users to access information on digital archives. •Creating a security system for the digital archive to prevent unauthorized persons from using the information. •Preventing data from being used for copyright infringement using notification for users through the website. •Embedding metadata in movement data files, and preventing metadata modification, through the Hash process, which breaks down files, or data, into appropriate sizes to solve basic problems.	CTS#16 Security.

5.2. Storing movement data to the intangible cultural heritage of living digital archives.

The storing movement data standards in the intangible cultural heritage of living digital archives found that there are 4 main elements such as 1) collecting data, data processing, and utilization of mobility datasets for living digital archives, 2) model regarding copyright management of information resources, which is an intellectual property agreement, 3) defining the characteristics of knowledge recording according to the FRBR concepts, and 4) metadata schema using the application profile concepts as follows:

1) Collecting data, data processing, and utilization of mobility datasets for living digital archives are shown in Figure 1.

1.1) Collecting data: Motion capture file format datasets, a format for exporting data from motion capture systems and data file properties, including BVH, C3D, FBX, etc., for raw data storage shown in Table 2, and Table 3.

1.2) Data processing: Motion Capture file format datasets include BVH, C3D, FBX, or other files related to coordinate systems, which are checked and cleaned by the dataset producer, including motion capture clean-up, and editing & skeleton/rig. These datasets will be stored in the form of 3D Markers position (X, Y, Z Axis), or skeleton and bones called raw data, the nature of data storage can record the length of animation frames. All continuously (Start frame to end frame), and 1 file per 1 set of performances, without cutting animation frames, data needs to be recorded as a set of performances. 3D viewer datasets include GLTF, GLB, USDZ, or other files. Related to storing 3D model animation files, producers will check file properties to be as specified by the data

warehouse system, including texture, vertex/polygon, and length of animation frames, this set of data, will stored in the form of a 3D viewer on the website's interaction page. One display set can be separated into sub-files for studying data on each dance move, according to the number of dance moves in that performance, each dance move will be checked for length not to exceed 10 seconds to ensure efficiency in processing data on the website at a fast.

1.3) Usability: A new media/ multimedia group can use the motion capture file format dataset for retargeting animations to characters by usability in new media including 3D games, 3D animation, augmented reality, virtual reality, mixed reality, metaverse, etc. Groups of users of intangible cultural Heritage content for study, and research, can study a performance through the 3D viewer datasets and can study it as a dance. A performance consists of several dance moves, including being able to study and learn from a variety of media data, such as documents, images, audio, video, and 3D animation, etc., studying individual moves or all the moves of a performance.

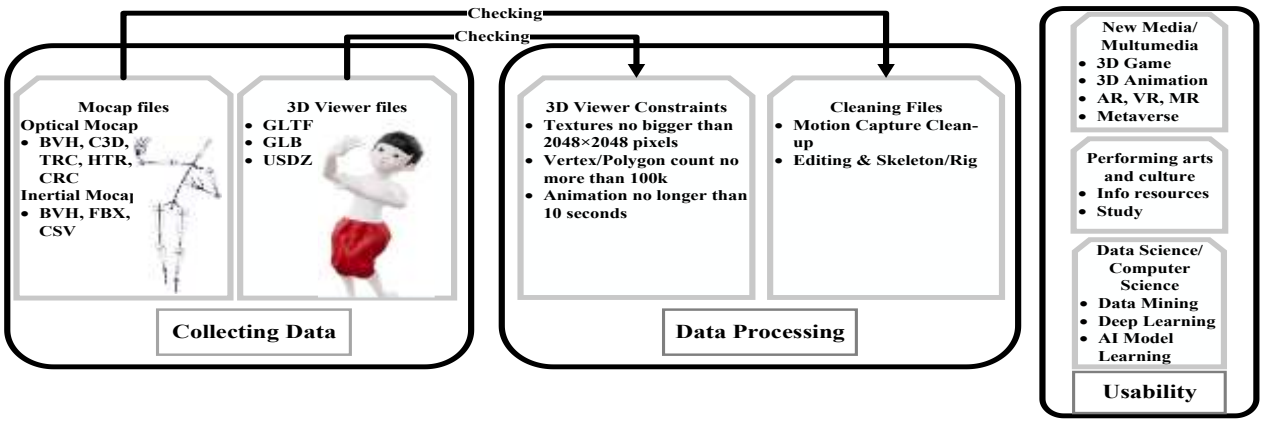

Figure 1. Collecting data, data processing, and utilization.

Table 2. Motion capture file format datasets.

Mocap system.	**File type.**	**Format type.**	**Represent Data.**	**General stored information.**	**Applied for animation / Multimedia.**	**Applied for Computer / Data Science.**
Optical mocap.	BVH, C3D, TRC, HTR, CRC	Binary, ASCII	3D Markers Position (X, Y, Z Axis)	Frame rate, Frame range, Scale, Units, Axis Convention (X, Y, Z Axis), Specific software, etc.	Retargeting animations to characters	CSV/ Spreadsheet software
Inertial mocap.	BVH, FBX, CSV	Binary, ASCII	Skeleton and Bones, Marker sets 3D positions (x, y, z)	Body part Description (Sensors, Joints, Bones), coordinate system, Specific software etc.	Retargeting animations to characters	CSV/ Spreadsheet software

Mocap system.	**File type.**	**Format type.**	**Represent Data.**	**General stored information.**	**Applied for animation / Multimedia.**	**Applied for Computer / Data Science.**
Other related.	Specific 3D software/ mocap systems.	Binary, ASCII.	A raw X, Y, Z Axis.	Coordinate system, specific software, etc.	Retargeting animations to characters.	CSV/ Spreadsheet software.

Table 3. The 3D viewer dataset is a collection of 3D model animation files including GLTF, GLB, USDZ, etc.

File type	**Format type**	**Usability in new media**	**Represent 3D models**	**Materials**	**Textures Formats**	**Embed metadata**	**Animation**
GLB	Text-based (Binary container format of glTF)	AR, VR, MR multiple platforms and Android devices	Mesh geometry, point cloud	Physically based materials and custom shaders	JPEG, PNG, and KTX (Khronos Texture)	Author, version, and more	Skeletal, rigging
glTF	JSON (JavaScript Object Notation), Binary data	AR, VR, MR multiple platforms and Android devices	Mesh geometry, point cloud	Physically based materials and custom shaders	JPEG, PNG, and KTX (Khronos Texture)	Author, version, and more	Skeletal, rigging
USDZ	Zip file (USD files: USDA, USDC, and USD formats), Image and Audio	Apple ecosystem and by developers targeting iOS devices	Mesh geometry, point cloud	Physically based materials	JPEG, PNG, and EXR	Author, copyright, and more	Skeletal, rigging

2) Model regarding copyright management of information resources, which is an intellectual property agreement as follows:

2.1) Administrator rights: The person must check the information of the information provider to verify the correctness of copyright before the information is published on the website of the Living Digital Archives. In the case where the copyright belongs to the university alone, only one person will have the authority to make decisions, but if the copyright owner's information belongs to a third party, permission must be requested, the contact information will be provided on the living digital archives in the form of a contact email, or if it is information from a research project, such as in the case of student research, occurring in the form of a thesis at the undergraduate/graduate level. The university will be the co-owner of copyright in the innovations specified in the legislation issued by the Ministry of Higher Education, which requires students to share a percentage of ownership of the work, which was previously the sole owner of the university. However, it depends on the regulations issued by the university for managing each intellectual property differently, and it may take the form of a committee deciding to grant rights in proportion to what the university regulations specify.

2.2) Rights of contributors: For copyrighted 3D character data, e.g., characters designed by copyright-free software (Opensource), or licensed software, the software must be properly purchased in the form of requesting permission for use in education (Education License) only. As for the textures that are organized image collection must be accurate and clear, not import image data from the internet, or bring data from the copyright owner without

permission, and data must be verified before uploading to accept that all data uploaded is not there has been a violation of copyright, and the distribution of movement information has been accepted according to the specified conditions.

2.3) Rights to access information: For service users for users, movement datasets can only be downloaded as skeleton datasets, which will not allow the downloading of 3D characters, which are only used for creating understanding for viewers. Which is in the file format .gltf, .glb. It will be displayed in 3D preview format where you can view the dance moves in 360 degrees on the website, of Living Digital Archives. But in the case of wanting a .gltf, .glb datasets file you must request specific permission to use it because this data file is like storing data as a model file which has elements, namely the model (Mesh Geometry) that is an image. The shape of the character includes photos/digital paintings of the surface attached to it.

3) Defining the characteristics of knowledge recording according to the FRBR concepts including work of Knowledge structural, with the dance performance datasets, divided into traditional dance performance series, and applied dance performance series. Expression of physical objects, including the teaching of great teachers, performances by artists, performing arts, performing arts traditions, recording history, traditions, festivals, stories, legends, and ethnic groups including language, and composition. Bodies, musical instruments, jewelry, works of art, lifestyles, beliefs, rituals, etc. Manifestation of converting/producing, and storing digital information, including digital printed media, multimedia media, motion capture data, etc. Items of accessing digital information resources (Item) include document files, sound files, picture files, video files, skeleton files, 3D animation files, and URI/files as shown in Figure 2.

4) Metadata schema is a design of the structure and organization of digital information resources, consisting of storage media types, file attributes, and metadata structures. The living digital archive will have an extension from other types of digital archives, with two types of motion capture data stored: Skeleton files, which have the attributes of raw mocap data, and 3D animation files, which have the attributes of a data set as a 3D viewer for displaying on a website, as shown in Figure 3.

5) Metadata schema using the application profile concepts on the process for considering the consistency of elements in content and knowledge characteristics, considering the consistency of elements of 5 types of storage media: digital print media, digital audio media, digital image/video media, motion capture data, 3D animated characters, with three appropriate metadata standards: Dublin core metadata, metadata object description schema, and lightweight information describing objects, content 8 elements, digital publishing 18 elements, audio 15 elements, image/video 14 elements, motion capture 19 elements, 3D animated characters 14 elements, with the metadata schema generated from analysis of DC, MODS, LIDO standards, and the need to record specific data in the storage type. Motion capture data includes MocapHardware, MocapSoftwareVersion, CountSensors, CountMarkers, Frame Range, etc., as shown in Figure 4.

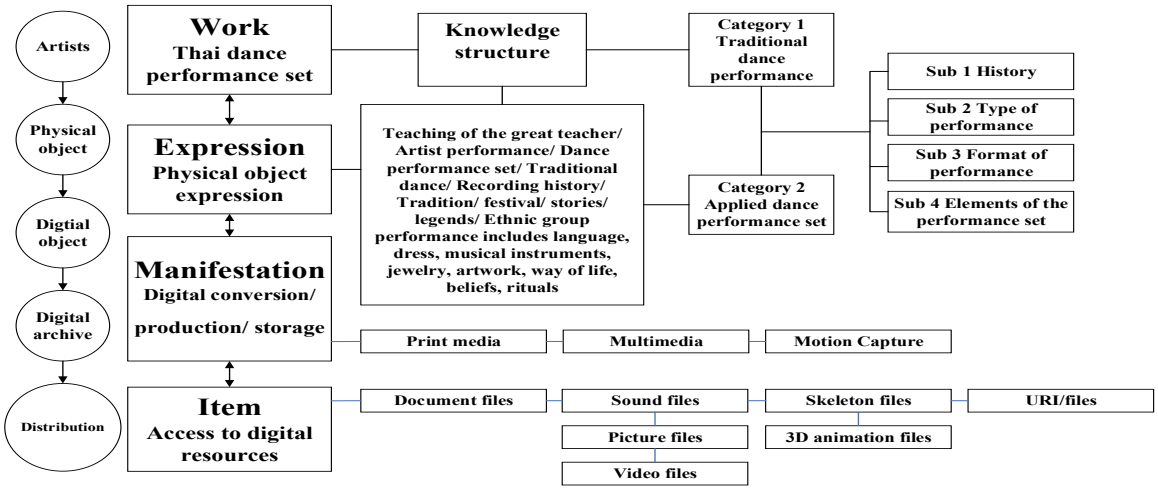

Figure 2. Application of the standard characteristics of knowledge recording according to FRBR concepts.

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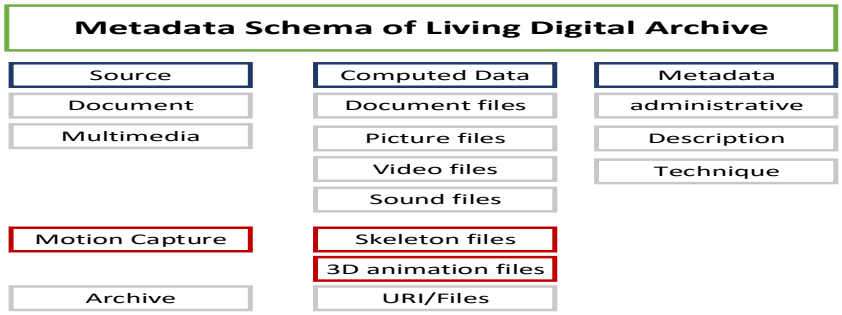

Figure 3. Metadata schema of Living Digital Archive.

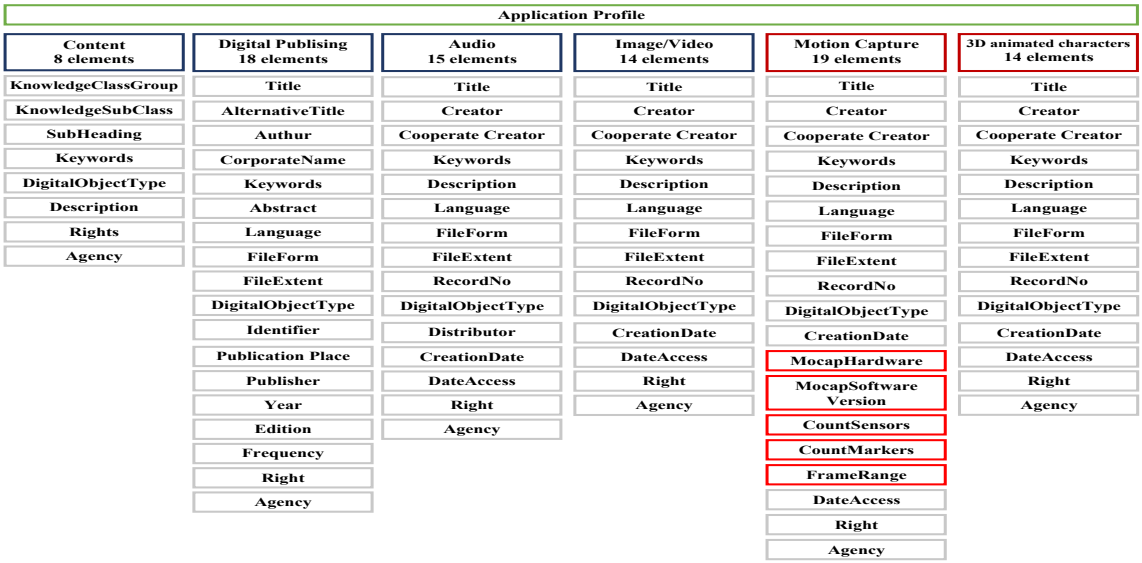

Figure 4. Metadata schema using the application profile concepts.

5.3 Significant of living digital archives.

The core system design of a living digital archive web application to follows:

1) Authentication login to separate user groups according to data access rights and scope of system users' duties, including:

1.1) The system administrator has the following rights and duties: (1) the right to manage the overall system, from system installation and configuration, system maintenance, data backup, and security, (2) the right to manage data from storage, metadata management, data access control and adding/deleting in data editing, (3) user management, from adding and deleting users, assigning user roles, and managing passwords, (4) providing user support, from answering user questions and providing training on the use of the living digital archive system.

1.2) User groups include (1) general users who have rights and duties in the right to search and retrieve information but cannot be members, cannot store information and request information, e.g., motion capture information, etc., (2) users who can be members who have two rights and duties: (2.1) Users will use the search tools provided by the system to search for the desired information. (2.2) Access to information: when the desired information is found, users can access the information immediately, e.g., documents, images, audio, video, and 3D Viewer. In case of wanting to download a data file, the user must request the data in the system along with supporting reasons and wait for confirmation. When approved by the system administrator, the data file can be downloaded, (3) utilization of data by users can use the obtained data for various purposes, e.g., making reports, writing articles, etc., but before downloading, the user must read the copyright details and understand, and accept the terms and conditions regarding restrictions, (4) providing feedback, in which users can provide feedback on the living digital archive system to help improve and develop the system, whereby data deposit rights can be obtained by, (4.1) preparing data by checking the accuracy and completeness of the data to be deposited, the data

file formats supported by the system, and the information that must be specified in the metadata, namely the dance knowledge set, and the types of digital media, multimedia, motion capture, and 3D Viewer, (4.2) the submission of the deposit data is complete for the completion of the metadata filling, and the data file, including the completeness after uploading, and (4.3) the check of the deposit status by the administrator will check the correctness, and completeness of the data file, in case the data file is wrong or the data is incomplete, the administrator will send it back for correction, and if there is no error in the data file and the data is correct, the administrator will publish the data on the website.

2) Database system as follows:

2.1) Member database to store metadata and user information, where users will register and confirm their rights via email, while administrators will be able to manage access rights to the data.

2.2) Content database, and knowledge characteristics to store metadata of dance performance data sets according to knowledge structure, consisting of traditional dance performance sets and applied dance performance sets.

2.3) Digital Print Media Database to store metadata and digital document files.

2.4) Digital Audio Media Database to store metadata and digital audio files.

2.5) Digital Image/Video Media Database to store metadata and digital image/video files.

2.6) Motion Capture Media Database to store metadata and motion capture files, in the form of raw data sets, such as FBX, BVH, C3D, etc., including CSV data table files.

2.7) 3D Animated Character Database to store metadata and 3D Animated Character files, in the form of data sets that are displayed in 3D Viewer, e.g., GLB, Gltf, etc.

2.8) Performing Arts Artist Database to store metadata, and artist history files.

2.9) Deposit database where users can import metadata and data files, including content and knowledge characteristics, digitally printed media, digital audio media, images/video clips, motion capture media, 3D animated characters, and dance artist data.

2.10) Order database to store data on the user's request for approval to use data, by typing the supporting reasons, and accepting the terms of use of data related to copyright, the data will be recorded by the user and there will be a link between the user to submit the request for approval, and the system administrator to consider the request for approval to use data.

3) Living digital archives web application includes:

3.1) The elements of the Living Digital Archives website include (1) the design and layout of the logo at the left-hand corner of the website, (2) the design of a banner explaining the purpose of the Living Digital Archives, (3) the design of a menu bar button at the top of the website for easy navigation, and the design of a push-button button for easy and noticeable actions, (4) the design of the login button and the member registration button, (5) the layout of the main page elements, and the division of the content of the presentation set into lists, (6) the design of the information presentation using 3D Viewer technology, and beautiful and interesting graphics, (7) the design of the text explaining the services of the living digital archive, and (8) the design of the Footer at the bottom of the website page to show details for linking internal departments and cooperation networks as shown in Figure 5.

3.2) Member management system in the user section can add member information, and edit personal history.

3.3) Dance performance data display system, users can log in and select the dance performance data they are interested in from the website, which will be displayed in 3D Viewer format as shown in Figure 6.

3.4) Data deposit system, users can enter the system to deposit data on the Living Digital Archives web application by adding data items according to the specified metadata format, which is (1) content and knowledge characteristics data deposit system, where users can deposit content and knowledge characteristics data, including title, keywords, new knowledge categories, types of performances, history, performance formats, components of performance sets, abstracts, creators/producers, data copyright, organization names, and performance set cover images, (2) a system for storing digital media and multimedia data by cataloging data according to metadata formats and attaching digital and multimedia files, which can separate data cataloging according to the types of digital and multimedia files, including digital print media, digital audio media, digital image media/video clips, motion capture media, and 3D animated character media, and dance artist data.

3.5) Data utilization request system where users can log in and request data utilization, users can request data utilization by typing the user's reason for needing to utilize the motion capture data set and reading the conditions

first which will be data copyright restrictions, which must accept the conditions for requesting data utilization, and request approval to use the data, the system will send the matter to the system administrator for review.
3.6) Data verification system by the administrator, (1) deposit data verification system, where the administrator will check the status of the system, if there is deposit data in the system, the system will verify the data, if the deposit data is not correct or complete, the administrator will return it to correct the data to be complete, and there will be a notification status in the system. The user will correct the data to be complete and correct, then press the “Update data” button and press the “Confirm” button again, when the administrator checks the data that is correct and complete, the system will notify the status “Approved”, after which the data will be published on the website of the Living Digital Archives application, (2) the system checks the approval request for data usage, the administrator will check the status of the system if there is data request for data usage, the administrator will check and consider the reasons from the user who requested the data if the reasons are not enough, the administrator can consider the result (not approved), and there will be a notification status in the user's system. If the administrator checks, that the data has sufficient reasons, the system will notify the user of the "Approved" status, after that the system will have a button to download the data on the Living Digital Archives application website.

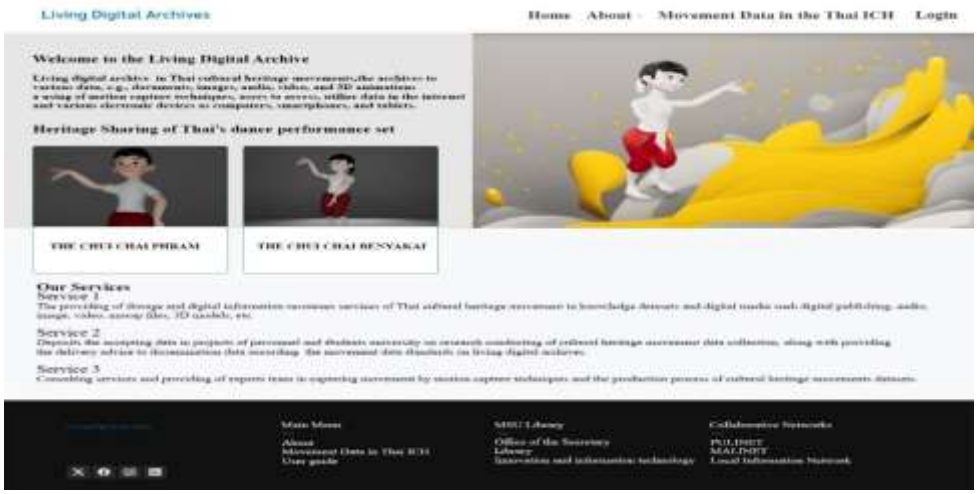

Figure 5. Living Digital Archives website.
Source: https://surincampus.org/living (In Thai)

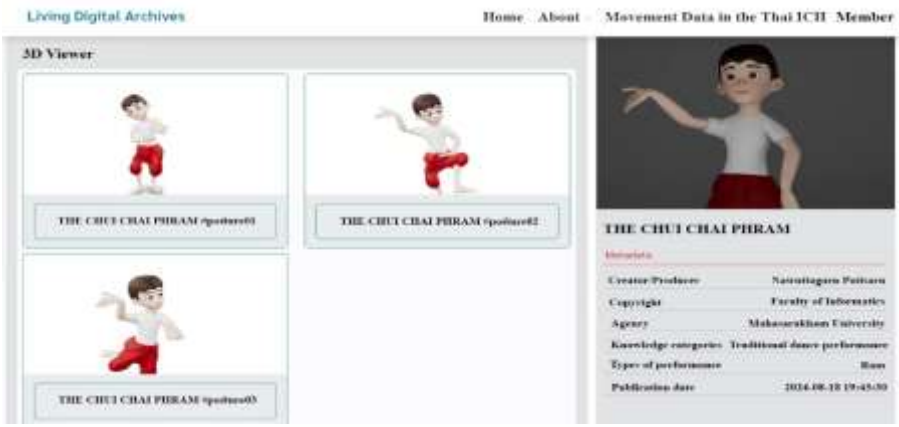

Figure 6. 3D Viewer Dance Performance Data Display System on the Living Digital Archives Application Website.
Source: https://surincampus.org/living (In Thai)

5.4 Efficiency and satisfaction with the use of living digital archives web application.

The satisfaction with the use of living digital archives web application to a high level (Mean of 4.24), and the different genders and age found not different satisfaction with the use of the living digital archives web application, respectively.

6. DISCUSSION

The model of living digital archives compares elements such as corporate infrastructure information resource management, technology, and security, according to standards in CoreTrustSeal with the context of living digital archives. This is caused by implementing a standard framework for living digital archives, to store movement data leading to the preservation, and dissemination of unique and culturally valuable movement information as appropriate with quality technology and operating within the framework of policies, laws, and copyright protection for the works of the university and creators [2]. Develop a data deposit system, and a data quality review system, and provide services to users to access data, movement datasets, metadata, and digital objects through a digital archive system to continuous life. Wherein, management is based on good governance in budget allocation, and adequate staff to meet the needs of access to living digital archives for students, teachers, officials, and university personnel [7], especially, the application of modern technology to manage valuable data in cultural performing arts, a mechanism for consulting experts to listen to recommendations in each relevant area to continuously improve the feedback results [28]. Select and store movement datasets, and knowledge sets, with metadata.

While, the evaluation of data from depositors is consistent with quality criteria for selecting data for storage/preservation, and dissemination [9], and Yang et al. [17] to define processes including data import processes, data management processes, data preservation processes, and data dissemination processes as well as set plans for data preservation and future data transfer [29]. However, the objectives, scope, definitions, duties and responsibilities, work procedures, and work process diagram. A living digital archive is a storage of media and metadata, retrieval by metadata, and media or semantic retrieval, using ontology, and defining codes to link access to persistent data identifiers, by providing a standard metadata cataloging format [18], a having a database that can link to other databases. Other data and metadata that can be used, and guidelines for using motion data files include motion capture data and 3D viewers, the technology and data input processes include data output from industrial motion capture technology, e.g., optical motion capture systems, and electromagnetic motion capture systems [10],[30]. Technology with the process of data management, and data preservation, including server computers and internet networks, digital inventory software that can store data, and connections to other database networks that can support changes in technology and the information dissemination process. Therefore, managing rights for users to access information on digital archives, and creating a security system for the digital archive to prevent unauthorized persons from using the information, includes preventing data from being used for copyright infringement using notifications for users through the website, and embedding metadata in movement data files, and preventing metadata modification, through the Hash process which breaks down files, or data into appropriate sizes to solve basic problems to effectiveness.

Also, the collecting data in motion capture file format datasets, a format for exporting data from motion capture systems and data file properties, for raw data storage, and data processing in motion capture file format datasets include BVH, C3D, FBX, which are checked and cleaned by the dataset producer, motion capture clean-up, and editing & skeleton/rig [31]. This dataset will be stored in the form of 3D markers position [4]. The storing 3D model animation files, producers will check file properties to be as specified by the data warehouse system, including texture, vertex/polygon, and length of animation frames, this set of data, will stored in the form of a 3D viewer on the website's interaction page. One display set can be separated into sub-files for studying data on each dance move, according to the number of dance moves in that performance, each dance move will be checked for length not to exceed 10 seconds to ensure efficiency in processing data on the website at a fast [19]. Usability in the new media/ multimedia group can use the motion capture file format dataset for retargeting animations to characters by usability in new media including 3D games, 3D animation, augmented reality, virtual reality, mixed reality, and metaverse. Groups of users of intangible cultural Heritage content for study, research, and research, can study performance through the 3D viewer dataset and can study it as a dance. Administrator rights the person must check the information of the information provider to verify the correctness of copyright before the

information is published on the website of the living digital archives, rights of contributors or contributors for copyrighted 3D character data, e.g., characters designed by copyright-free software [24]. For the textures that are organized image collection must be accurate and clear, not import image data from the internet, or bring data from the copyright owner without permission, and data must be verified before uploading to accept that all data uploaded has not there has been a violation of copyright, and the distribution of movement information has been accepted according to the specified conditions [2], and rights to access information for service users for users, movement datasets can only be downloaded as skeleton datasets, which will not allow the downloading of 3D characters [25], which are only used for creating understanding for viewers.

In this regard, including defining the characteristics of knowledge recording according to the FRBR concepts including work of knowledge structural, with the dance performance dataset, divided into traditional dance performance series, and applied dance performance series, and expression of physical objects [1], Manifestation of converting/ producing, and storing digital information, including digital printed media, multimedia media, motion capture data, etc. The digital information resources include document files, sound files, picture files, video files, skeleton files, 3D animation files, and URI/files [26]. Metadata schema using the application profile concepts on the process for considering the consistency of elements in content and knowledge characteristics, considering the consistency of storage media on digital print media, digital audio media, digital image/video media, and motion capture data. Also, 3D animated characters, with three appropriate metadata standards in Dublin core metadata, metadata object description schema, and lightweight information describing object content, digital publishing, audio, image/video, motion capture, and 3D animated characters, with the metadata schema. Also, motion dataset production can define the characteristics of Mocap files and 3D Viewer for a wide range of user groups, especially for dance learning that needs to develop various multimedia or instruction that has realistic movements [32].

However, the living digital archive website application prototype has resulted in a variety of mobility data storage formats, multimedia storage media, and 3D technologies. The focus is on the collection of cultural heritage mobility data that can create user community participation, with a data storage system that can share valuable mobility data, and data dissemination using 3D Viewer presentation techniques. The ease of accessing 3D mobility data via a web browser [33]. Meanwhile, the selection of a specific 3D model viewer function on a digital repository and the integration of diverse features, comprehensive metadata, and usability [34] by the living digital repository uses JavaScript Object Notation (JSON) to encode 3D model files for presentation via web browsers, the ability to access raw motion capture datasets, by requesting the use of datasets for educational, research, by managing intellectual property by rules and regulations, and also the idea of expanding the scope of data exchange between digital repositories to create a data storage network with metadata.

7. CONCLUSION

The movement data in the intangible cultural heritage in the model of living digital archives including corporate infrastructure, information resource management, and technology and security. The significance of living digital archives of 1) authentication login to separate user groups according to data access rights and scope of system users' duties, 2) database system on member database, content database, digital print media database, digital audio media database, digital image/video media database, motion capture media database, 3D animated character database, performing arts artist database, deposit database, order database, and 3) living digital archives web application including (1) the design and layout of the logo at the left-hand corner of the website, (2) the design of a banner explaining the purpose of the Living Digital Archives, (3) the design of a menu bar button at the top of the website for easy navigation, and the design of a push-button for easy and noticeable actions, (4) the design of the login button and the member registration button, (5) the layout of the main page elements, and the division of the content of the presentation set into lists, (6) the design of the information presentation using 3D Viewer technology, beautiful and interesting graphics, (7) the design of the text explaining the services of the living digital archive, and (8) the design of the Footer at the bottom of the website page to show details for linking internal departments and cooperation networks. The efficiency of living digital archives web application of functional requirement testing, functional testing, usability testing, performance, and security to a high level, and satisfaction with the use of living digital archives is high level. The living digital archives web application results in the collection

of cultural heritage movement data with motion capture techniques in the form of a 3D coordinate system for an effective data set.

The development of the prototype web application of the living digital archive system will result in the importance of collecting the movement data of cultural heritage with the motion capture technique in the form of a 3D Coordinate System data set and publishing the movement through the living digital archive system with the 3D Viewer, taking into account the reliable and correct data, the clear and verifiable source of the data, the connection of the digital library network, the digital archive, and the digital museum to integrate the collection, storage, and access of data through the living digital archive system. In addition, the process of promoting the use of the living digital archive for service users, by organizing training to provide knowledge to students and personnel within the organization to be able to use the storage system, and access data through the living digital archive, and have a process of asking for opinions from users to provide feedback for improving the system, taking care of maintaining, data security effectively.

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Institutional Review Board Statement

The study received approval from the of Mahasarakham University Ethics Committee: Approval: 308-306/2023

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