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Preserving Karawitan through a Validated-Archive Web Based Digital Library

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***Abstract*—This study aims to support the preservation of *Karawitan*, traditional music from Java, that consists of Gamelan as music instruments and gendhing as traditional Javanese songs. The development of KDL was focused on the documentation of song data containing five attributes, which are sheet music, lyric, song description, audio and video. The Validated-Archive Web (VAW) based digital library (DL) model which is centred on user activities in DL management was implemented for developing the KDL. One way to increase the amount of collection is to provide open access for users to upload contents. However, the validity of data in the Karawitan preservation must be prioritized. The mechanism in maintaining the validity of the data was carried out by grouping users based on their roles and access restrictions based on user level. Based on the evaluation of accessibility and usability interface, the development of KDL that implemented the VAW based DL model can function well. Moreover, the tasks of administrators who tend to be technical tasks can be carried out well. The data collection in KDL is proven to be well managed in based on user centre activities.**

Keywords—validated-archive web, digital library, cultural heritage preservation, karawitan

I. INTRODUCTION (*HEADING 1*)

This study aims to support the preservation of Karawitan, traditional music from Java, that consists of Gamelan as music instruments and gendhing as traditional Javanese songs. Karawitan content information, especially traditional Javanese songs data, is difficult to access because more data are stored in hard copy than in comprehensive literature. Song data are widely distributed on various personal blog sites with unstructured and irregular presentation, such as without indexing and categorization, as well as a limited amount of song collections. The such conditions are similar to problems faced in the rich cultural heritage but weak in the management (Zhou et al., 2019). Structured and organized song documentation with easy access and search for song information, including maintenance by always increasing the amount of song collections, is needed for the preservation of Karawitan, and digital song documentation using online publication through digital library (DL) can be the solution. DL provides benefits for increasing and expanding access because it is not limited by time and place, contents can be accessed by many users simultaneously, as well as increasing the document preservation since what is accessed is digital documents, not physical documents (Kumar et al., 2014). Therefore, the Karawitan Digital Library (KDL) was developed to manage documentation of traditional Javanese songs, so they can be easily accessible by users. On the other hand, the main problem faced in the KDL development is the collection of contents and data digitization, as well as their maintenance in order to achieve sustainability of digital collections described by Yakubu et al., (2021) as "an ability to maintain a standard in providing access to resources and services, experts, technological and software components, storage and retrieval system over a long time to satisfy the information needs of future generations". In the context of KDL development, it takes a long time that can reach years to collect contents that are widespread in different regions or cities. Meanwhile, maintaining and increasing the quantity and quality of contents are challenges in the development of DL. Data collection and utilization is the basis of existence in digital library management (Freire et al., 2020). Providing access to data collection for users through an online website is one alternative solution in an effort to increase the amount of content. An archive site is a type of Web that allows users to share information and store in electronic archives, etc., for example wikipedia.com, archive.org, academia.edu, and others.

An online DL is a type of archive site that provides various resources, including specialized staff, to select, organize, provide intellectual access, interpret, distribute, maintain the integrity of, and ensure the sustainability of the collection of digital works (Waters, 2022), and contains a collection of objects that include, text, images, video, and or audio, which are organized and centralized, with the application of access and retrieval methods (Smith, 2001). There are open and closed models of collecting digital collections through archive sites. The open model allows any user to add or edit contents in a digital library, such as in wikipedia.com, where one content can be edited by multiple users. This model can increase the amount of content, but is weak in content validity. The closed model can maintain content validity by performing filtering. In general, a content by a single creator or group of creators that is published through a review process. This model is commonly used in online journals, or academic digital libraries. The amount of content in a digital library with this management model depends on the number and productivity of users. A large number of users with a high level of productivity increases the amount of content. The Validated-Archive Web (VAW) based DL model proposed by Hastuti et al. (2021) combines open and closed models for DL development. This model can support the speed of adding collections while maintaining the validity of the

content. The VAW based DL model which is centred on user activities in DL management was implemented for developing the KDL.

II. Related Works

The COVID-19 pandemic has resulted in the availability of more time for users to search and read more digital content (Parikh et al., 2020), and academic libraries have become a central service in providing online learning resources (Martzoukou, 2021). Indirectly, this situation provides a greater opportunity for the existence of DL as an alternative for users in searching for information. The existence of DL cannot be separated from technological developments, and user readiness in following technological developments is needed in managing DL, especially in a user-centred DL model as the VAW based DL model. The Technology-Organization-Environment (TOE) framework which focuses on the technological context, organizational context and environmental context in implementing technological innovation in organizations, is feasible to be applied in digital libraries (Singeh, et al., 2020). On the other hand, not all users are in that position due to the high gap in user characteristics based on background, skills, and experience in operating Web archives (Fritz et al., 2020). The help, documentation, and question-and-answer features in the operation of DL can be a solution for users who still need support in understanding and mastering technological innovations implemented in the digital library. These features should contain instructions that are described succinctly and clearly, while the question-and-answer feature should be actively managed.

A cultural heritage DL must meet the principles of re-usable for the sustainability, relevant that evolves in memory and transform into cultural resource that characterized their life cycle, reliable to represent the validated and certified processes, and resilient as requirements to recover and reuse over time descriptive metadata, as a source of knowledge for future generations (Barbuti, 2020). A preservation framework for ancient Chinese books was developed based on three layers with a foundation for preserving archaeological values, a middle layer for preserving historical research values and a top layer for preserving techniques and procedures for producing artistic formats (Li and Niu, 2010). The use of a GitHub data repository for collections makes users easily accessing DL, and in the context of computing, many cases are found that per-content evaluation is needed to determine the type or format of data that can support the use of computing (Wittmann et al., 2019). The Louisiana Digital Library was also developed as a data Hub to gather and share the metadata of the participating institutions (Ziegler, 2020). Descriptive metadata distinguishes digital cultural entities from digital "consumption" data, and a good description of metadata in the digitization process for cultural heritage is needed to preserve information (Barbuti, 2020). Data Element values for a collection vary, mostly the same or mostly different so that a metadata record graph based on the subject metadata element can be used to manage the metadata records (Phillips, et al., 2019). A digitization process using XML to encode artefact properties for the ontologies link was used by (Stapleton, et al. 2019). Data collections in DL are controlled and managed by metadata, thus the use of metadata is as important as the physical presentation of the data.

The Qatar Digital Library which has more than 1.3 million pages was developed to increase understanding of the Islamic world, Arab cultural heritage and modern history of the Gulf (Al-Mutawa, 2019). Meanwhile, a worldwide translations knowledge information system in preserving cultural heritage was focused by translating data into multilingual parallel corpora in order to expanding linguistic and traditional diversity (Fraisse, et al., 2019). Management of DL does not only focus on the amount of collection and multi-languages, but the user experience also needs to be a focus. User-centred design in the Agile software development methodology was developed by (Anuar and Othman, 2020) for cultural heritage DL based on progressive Web App, in which the system was designed by collecting user's ideas. A framework which is more than user-centred design was proposed by (Pereira, et al., 2021) where all stakeholders must be participated in a multidisciplinary intervention framework to preserve cultural heritage buildings, including for higher-education cultural heritage buildings, in which the intervention framework must meet the new construction technologies.

III. Methodology

The development of the KDL was focused on the documentation of song data. Song data managed in the KDL contain five attributes, which are sheet music, lyric, song description, audio and video. Data type formats can be text, image, audio, video, and animation. A song that has complete data consisting of five attributes is rarely found from a single source. This fact becomes a challenge in content collection. There is a possibility that the song data uploaded by users does not meet all the five attributes. The solution is to combine the same song data from more than one user, with a note, if there is more than one user upload the same song data. The solution does not guarantee that every song data has information on all of its five attributes. Therefore, an information box that conveys a message that the attributes of the song data are not completely filled in will be displayed to users. In addition to the purpose of informing the completeness of song data attributes, the information box is expected to provide motivation for users to complete song information. Figure 1 shows the illustration of the mechanism in collecting information of all the five attributes of a song.

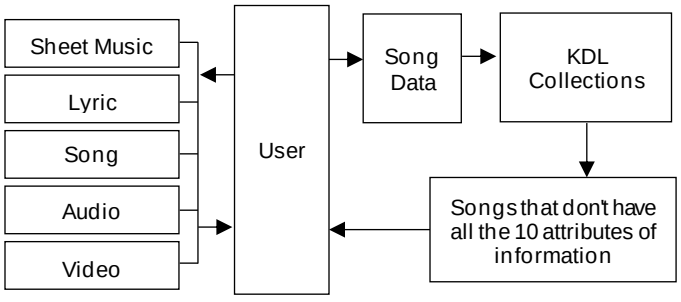

Fig. 1. Mechanism in collecting information of all the five attributes of a song

Storage of data in audio and video formats can overload the storage capacity of the KDL servers. Therefore, the data in that format that is uploaded is a link from a third source, such as YouTube, Instagram, Soundcloud, and so on. License management can protect libraries from activities that violate

copyright law in the distribution of electronic information. The legality of the data uploaded in the KDL is the responsibility of the uploader (users). The disclaimer is conveyed clearly through the rules that the user must read before uploading data.

A. The KDL Model

The KDL model is centered on user activities in DL management. User activities at the KDL include upload, browse and search, download, validation, comment, rating, and discussion. Figure 2 illustrates the implementation of the VAW-based DL model on the KDL development. The amount of content affects the existence of the DL, and content collection needs to be maintained in the management of the DL. One way to increase the amount of collection is to provide open access for users to upload contents. However, the validity of data in the Karawitan preservation must be prioritized. Restrictions on individuals allowed to upload content were added to maintain data validity. Data collected from users with various backgrounds still requires validation. Therefore, authentication and authorization are required to maintain data validity. The mechanism in maintaining the validity of the data was carried out by determining user roles and access restrictions based on user level. User level was categorized in five types, which are guest, member, contributor, reviewer and administrator levels. The Guest level is characterized as users who are aware of the existence of the KDL, and they intend to search for information. This type of user can be individuals with various levels of knowledge about karawitan, or can be individuals who are new or currently learning karawitan, or already understand karawitan. The member level is characterized as users in the guest level but they have further interest. Similar to guest and member levels, but the contributor level is characterized as users who are more interested in participating in the preservation of karawitan. The reviewer level is characterized as users who are interested in participating in the preservation of karawitan, and they have a broad level of knowledge or karawitan experts. Meanwhile the administrator level is characterized as the librarian.

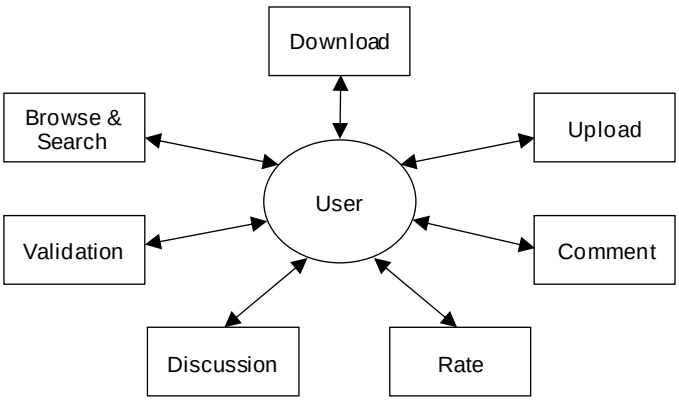

Fig. 2. Implementation of the VAW based DL model on the KDL development

B. Role-Based Access Control Determination

In addition to administrators, there are four levels of users, three of which are controlled by regulations through the registration form, which are member, contributor and reviewer levels. Membership at these three levels is controlled by the administrator, while the guest level is assumed to be an individual who is trying to know and seek information through the KDL, and does not yet have an interest in participating yet. Except for users in the reviewer level, one has to go through two stages to become a contributor, starting from the guest level and registering to the member level. The measurement of user seriousness is measured through the willingness of individuals who are in in the guest level for registering to be members. The member level registration form contains information on the user's name, email and affiliation. The seriousness of users is assumed to be a motivation in participating in the preservation of Karawitan. The contributor level registration form requires a minimum requirement of one content contribution from users who are in the member level. The contribution can be one of five attributes information. Meanwhile, users in the reviewer level are Gamelan music experts invited by the administrator. Figure 3 shows illustration of stages in user level.

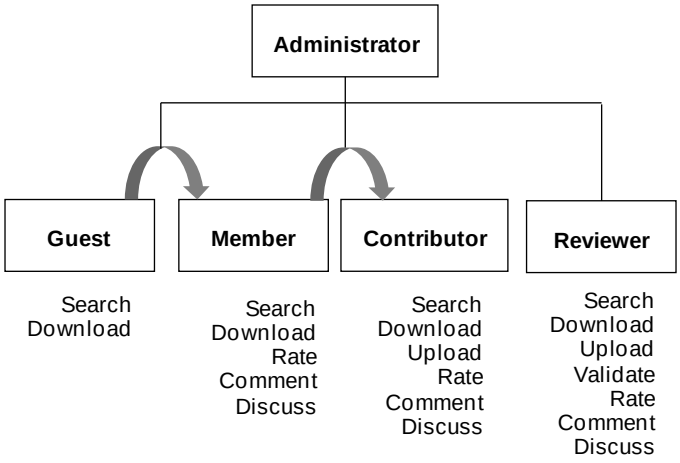

Fig. 3. Implementation of the VAW based DL model on the KDL development

Role-based access control was defined based on characteristics of the user levels. Individuals in the guest level can access and download contents. Individuals in the member level can access and download contents, write comments, rate contents, and join the group discussion. Individuals in the contributor level can access and download and upload contents, write comments, rate contents, and join group discussion. Individuals in the reviewer level can access and download and upload contents, write comments, rate contents, provide validity statements on data uploaded by contributor, and join group discussion. Table I describes the role-based access control for guest, member, contributor and reviewer levels with Y stands for the access granted and N stands for access not granted.

TABLE I. ROLE-BASED ACCESS CONTROL IN KDL

User Level	Access to Contents	Upload Contents	Download Contents	Comment on Contents	Rate Contents	Validity Statement	Discussion
Guest	Y	N	Y	N	N	N	N
Member	Y	N	Y	Y	Y	N	Y
Contributor	Y	Y	Y	Y	Y	N	Y
Reviewer	Y	Y	Y	Y	Y	Y	Y

The VAW based DL model makes users at the administrator level who act as librarians more likely to be technology operators with technical tasks that ensure the continued existence of the KDL, such as making reports on the development of the number of users and collections, ensuring all links can function properly. Meanwhile, the tasks of administrator in the librarian domain tend to be general management tasks which include ensuring the relevancy of uploaded content and responding to questions, criticisms and suggestions submitted through discussion groups, as well as responding to requests related to user level submissions. All content submitted by contributors will be presented in the KDL directly. administrators have a duty to check the general relevance of content. The evaluation of the depth of content is carried out based on the validation done by reviewers. Content that has been validated by the reviewer will be given a check mark and the name of the reviewer who validates. Another feature related to content is comments and rates. The comment and rate features are tools to measure the popularity of contributors. These features can be accessed by users at all levels except the guest level.

IV. RESULTS AND DISCUSSION

The development of the KDL was focused on the documentation of song data, and managed based on the VAW based DL model, where the model is centred on user activities. The user interface design is focused on a minimalistic layout, simple navigation, and colour themes setting based on user level. The KDL prototype has been successfully developed, and its web address can later be accessed via karawitan.com. In the prototyping stage, the evaluation is limited to measuring the accessibility and interface usability. The evaluation was carried out in a limited environment involving 50 users from various backgrounds that have relevance to Karawitan, such as students, students, teachers, and enthusiast of Karawitan who are outside the professions mentioned before. The profile of the respondent is described in Table II.

TABLE II. ROLE-BASED ACCESS CONTROL IN KDL

Age (Years)	Gender		Professions
	Male	Female	
11-18	5	5	Student
19-24	5	5	College Student
25-35	7	8	Teacher and Lecturer
36-50	9	6	Others

The evaluation scheme was carried out by selecting two respondents with a lecturer background, and two respondents with a musical practitioner background (another professional group) as reviewers. Therefore, there were 46 respondents distributed to act as guests, members and contributors. The 46 respondents were required to take on the roles of guest, member, and contributor in stages through confirmation from the administrator. When performing its role as a contributor, each respondent was provided with five song data complete with 10 information attributes. Meanwhile, reviewers were asked to perform validation tasks. All respondents were not given an explanation or instructions for operating the KDL, and they were asked to understand the KDL design by themselves. After gaining experience in operating the KDL, respondents were asked to rate the accessibility of the KDL based on all buttons and links at each user level having functioned properly. The range of values from 1-5 was determined with a value of 1 which represents very poor functioning to 5 which represents very well-functioning. Good results were shown by all respondents stating that all buttons and links on each user level page have functioned very well. The next evaluation was to measure the usability of the KDL interface based on the ease of operation of each feature consisting of uploading content, browsing and searching content, downloading content, validating content, commenting content, rating content, and discussion. The range of values from 1-5 was determined with a value of 1 which represents very difficult to 5 which represents very easy in performing tasks. 46 respondents rated the usability interface of all tasks except the validation task, while 4 respondents who acted as reviewers assessed the usability interface of the validation task. Table III shows results of the interface usability evaluation for the browse and search, download, upload, comment, rate, and discussion tasks.

TABLE III. RESULTS OF INTERFACE USABILITY EVALUATION

Tasks	Interface Usability				
	1	2	3	4	5
Browse and search	0	0	0	28	18
Download	0	0	5	21	20
Upload	0	4	17	19	6
Comment	0	8	19	10	9
Rate	0	0	0	35	11
Discussion	0	3	8	18	17

The assessment of 46 respondents on the accessibility of the browse and search task resulted in 28 respondents giving a score of 4, and 18 respondents giving a score of 5, and none of the respondents gave a score below 4. Meanwhile on the download task, five respondents gave a score of 3, 21 respondents gave a score 4, and 22 respondents gave a score of 5. There was a decrease in the respondent's assessment of interface usability regarding the download task compared to the browse and search task. The decrease in respondents' ratings regarding interface usability also occurred in the upload task compared to the download task. There were four respondents who gave a score of 2 or difficult for the upload task. The majority of respondents who gave a score of 5, and some respondents who gave a score of 4 on the download task shifted to a fairly difficult choice or a score of 3, which is a total of 17 respondents. This condition is also similar to the results achieved on the comment task.

This condition may occur because the upload task has more steps than the download task, and the download task has more steps than the browse and search task. This fact is also indicated in the discussion and comment tasks, where the assessments of the respondents are also spread in the score range of 2-5. The age factor may also affect respondents in carrying out upload tasks. 3 out of 4 respondents who gave a score of 2 on the upload task were respondents who were in the 36-50 age group, and the rest were respondents aged 11-18 years. This condition is also indicated in the discussion task, where all of the three respondents who gave a score of 2 on the discussion task were in the 36-50 age group. On the other hand, the rate task had the best level of acceptance by all respondents, in which 35 out of 46 respondents gave a score of 4, and the rest gave a score of 5. Evaluation of the validation task by four users at the reviewer level showed good results, where the lowest score achieved was 4 or easy. Figure 4 shows the results of the interface usability evaluation in chart format, and Figure 5 shows the results of the interface usability evaluation from the perspective of gender.

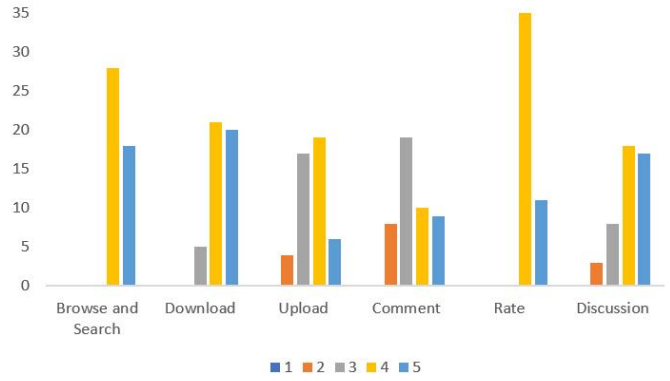

Fig. 4. Results of interface usability evaluation

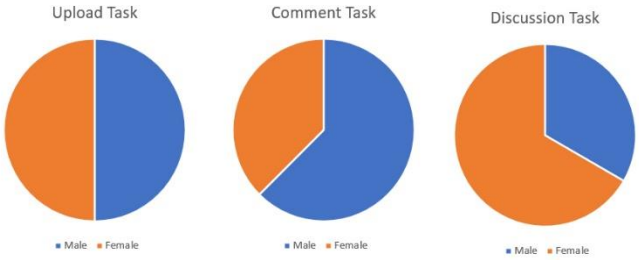

Fig. 5. Results of interface usability evaluation from the perspective of gender

V. CONCLUSION AND FUTURE WORK

Based on the evaluation of accessibility and usability interface, the development of KDL that implemented the VAW based DL model can function well. The tasks of browse and search, download, upload, comment, rate, discussion, and validation can be accessed by users according to their functions with a good level of acceptance of the usability interface. Likewise, the tasks of administrators who tend to be technical tasks can be carried out well. The data collection in KDL is proven to be well managed in based on user centre activities, where users are grouped into guest, member, contributor and reviewer level.

In addition to publishing online, there are still tasks to improve KDL, such as planning in recruiting users to participate, and implementing language options in Indonesian and English. At this time, KDL still uses one language, namely Indonesian. This is due to the consideration that users for the contributor level are still targeted to come from Indonesia. The implementation of language choices in Indonesian and English will be carried out by including the language translation automation feature, so that content in text format uploaded by contributors can be automatically translated from Indonesian into English or vice versa.

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