A Knowledge Resource Management System (KRMS) for the Academic Community

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ABSTRACT: Background: *Knowledge management has emerged as a strategic priority for the academic community. The ubiquitous utilization of powerful computing technologies and collaborations across disciplines means the academic community can generate, use and share voluminous as well as different forms of knowledge resources around the clock; a phenomenon commonly referred to as the fourth paradigm or e-Science. Similarly, managing these value attached knowledge resources in a form that can support complex hypermedia knowledge resources with their associated metadata and allow their improvement, ease in access, retrieval, sharing and collaboration and utilization has equally been challenging for the academic community.*

Objective
This study fleetingly reports on the design of a Knowledge Resource Management System (KRMS) that can be used to bridge this gapat Maasai Mara University Library in Narok, Kenya.

Methodology
The study assembles the know-how, expertize, experience, and computational solutions developed by research centers as well as institutions of higher learning to fashion an apt and all-inclusive Knowledge Resource Management System (KRMS) that can support complex hypermedia knowledge resources with their associated metadata at Maasai Mara University Library.

Results
An archetype of the Knowledge Resource Management system (KRMS) is being developed with very exciting features that could be a game changer in preservation, organization as well as management and utilization of complex hypermedia knowledge resources.

Conclusion
This study proposed an advanced Knowledge Resource Management system (KRMS) design that purposes to address the gap by employing novel features that can support complex hypermedia knowledge resources with their associated metadata. The novel features include the integration of technologies necessary for handling and managing complex hypermedia knowledge resources in all the stages of information such as acquisition, text mining, indexing searches and leisure.

Keywords: Knowledge Resource Center, Knowledge Resource Management System, Complex Hypermedia Knowledge Resources, Layout Design, Academic Community

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1. Introduction

Present-day Knowledge resource centers have been evolving rapidly due to technological advancements that have become more daedal, supporting intelligence and partnerships among various detached academic communities. The Knowledge resource centers are making noteworthy advancements with added and refined technologies that guarantee best practice and renewed life in the organization and management of information(Yang & Li, 2016). The technologies are enabling assimilation of varied knowledge resources; steering cooperation and partnerships in the academic community and at the same time ushering in a new era in knowledge resource organization and management (Barbuti, Ferilli, Redavid, & Caldarola, 2014).

Over the years, there has been a steady fruition of Knowledge management in Knowledge resource centers from simple digital interfaces to complex networks of knowledge resources that permit continued research and partnerships across the academic community (Ifijeh, 2014). The contemporary digital settings in Knowledge resource centers enable the users to access, share, evaluate and build knowledge resources. Nonetheless, there has been rock-solid difficulties in molding and fashioning a knowledge resource management system (KRMS) that can support complex hypermedia knowledge resources and associated metadata. (Patra, 2017). (Birkett, 2019) defines a Knowledge resource management system (KRMS) as an institutional or organizational system of information technologies that stores and retrieves knowledge resources to advance comprehension, collaborations and process alignment. In harmony with the study, a Knowledge resource management system ought to be able to store and retrieve knowledge resources, improve sharing of knowledge resources and collaborations, discover knowledge sources, mine repositories for masked knowledge resources, capture and utilize knowledge resources and also improve the knowledge resources. The author gives examples of learning management systems and knowledge bases such as tableau as some of the common examples of knowledge resource management systems. This study reports on the proposed implementation of apropos Knowledge Resource Management System (KRMS) at Maasai Mara University Library in Narok, Kenya. The main aim of the knowledge resource management system (KRMS) will be to supportthe Academic community's complex hypermedia knowledge resources with their associated metadata.

The layout of the study is fashioned as follows; the subsequent section presents a comparison of the major knowledge resource management systems with the intent of selecting the most ideal as per the user needs of the Academic community at Maasai Mara University. The third section minutiae the elements that should be integrated to the design of an ideal Knowledge Resource Management System(KRMS) in order to realize the envisioned needs of the Academic community at Maasai Mara University. The succeeding section gives a break-down of the distinctive features of the ideal knowledge resource management system i.e. content extraction capabilities, metadata construction and the indexing of scanned digital resources. The last section gives a conclusion of the project.

2. The Knowledge Resource Management Base

To settle on the most ideal design, it was indispensable for the study to investigate the existing Knowledge Resource Management Systems. The investigation lessened down to greenstone, E-prints and D-space; being the most habituated to and universally used (aalYateem & Hameed, 2015). Fedora commons was however not investigated since it is adapted towards preservation of knowledge resources other than the fruition (Xie & Matusiak, 2016a). Also the Knowledge Resource Management System does not amply support the Z39.50 protocol and the Machine Readable Cataloguing Standards (MARC) protocol both which are of significance in the choice of an ideal Knowledge Resource Management System(KRMS) (Xie & Matusiak, 2016a). The three Knowledge Resource Management Systems (KRMS) have the following characteristic features (Zervas, Kounoudes, Artemi, & Giannoulakis, 2019) (aalYateem & Hameed, 2015):

1. They all support Interoperability and Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH)
2. They store and manage any type of Knowledge resource
3. They all support a multilingual interface
4. They produce statistical reports as per the resource count

The differences between the three Knowledge resource management systems (KRMS) are (Xie & Matusiak, 2016b; Yang & Li, 2016; Zervas et al., 2019):

1. Greenstone is enabled by the Open Archive Initiative Identifier (OAI) (http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd), D-space by CNRI handle system (http://www.cnri.reston.va.us/) while EPrints does not rely on any conversion standard

2. Besides Dublin Core*and Metadata* Encoding and Transmission Standard (METS)that are conventional among the three knowledge resource management systems (KRMS),D-Space pillars the Machine Readable Cataloguing Standards (MARC) too while Greenstone supports the New Zealand Government Locator Service (NZGLS) and the Australian Government Locator Service (AGLS) as well.

3. D-space's retrieval functions (sorting logics, Boolean logic and field specific) are an assembly of those of EPrints and Greenstone.

4. EPrints uses the Cloud and MySQL databases while Dspace uses the PostgreSQL and Oracle databases. Greenstone has its own execution procedure.

5. EPrints and Greenstone permit use of any field in retrieval while Dspace permits use of Subject, Title, Author and Collection.

6. Authentication of users in EPrints is possible through Lightweight Directory Access Protocol (LDAP); User groups in Greenstone while D-spacepillars both Shibboleth and Lightweight Directory Access Protocol (LDAP)

Of the three Knowledge Resource Management Systems, the study settled on D-space because:

1. Innumerable communities offer DSpace support.

2. Its documentation essentials are also well documented and comprehensive.

3. It has a better support system for metadata standards interoperability and protocols compared to the other Knowledge Resource Management Systems (KRMS).

4. DSpace is based on only one programming language

3. Design of the proposed Knowledge Resource Management System (KRMS)

The design of the projected Knowledge Resource Management system (KRMS) will therefore be an extension of DSpace with additional advanced features. The design will have three echelons basically the Application level, the business logic level and the storage level (Chen & Zhang, 2014; Yang & Li, 2016).

The Application level will have the following modules (Chen & Zhang, 2014):

1. The Web UI which permits easy access to the back office and front area of the knowledge resource management system via a number of portals. Metadata creation and edition of digital resources that happens at the back office of the Web UI module. It is also the area that manages user access. The front office on the other hand enables collaborative tagging and imagining/ visualization of digital content via the web interface. The visualization of digital content is permitted through a combination of various advanced features warranting multi-channeling, hypermedia and protection. The Web user Interface is also responsible for access of the web.

2. Mobile device is another module with the key function of facilitating visualization of digital content through portable devises such as tablets and mobile phones.

3. The other is the Monitoring module whose function is to enable observation of behavioral characteristics of the system with the ability to generate reports in the form of Portable Document Format (PDF), Excel Format and the Extensible Markup Language (XML).

4. The last module in the Application layer is the Input/output module (I/O module) which enables the exchange of metadata

through Open Archival Information System (OAIS), Open Archive Initiative Protocol for Metadata Harvesting (OAI-PMH), Z39.50 and the Open Archive Initiative's Object Reuse and Exchange (OAI-ORE). The module also enables the visualization of digital content as open data.

The subsequent layer is the Business Logic level. The layer consists of the following modules (Patra, 2017; Xie & Matusiak, 2016a):

1. The core tools module which consists of the key entities responsible for logging and system configuration.

2. The Web module which is responsible for collaborative tagging that is; the module links the portal users and the content published.

3. The other module is the search engine which permits information retrieval. Indexing of content is done by lucene, a simple and powerful tool that facilitates fielded searching, stemming, stop word elimination and addition of novel indexed content.

4. The module access management permits profiling and authentication. It is the module responsible for management of access both in IDP (Identity Providers) or the normal mode.

5. Another module in the Business layer is the text extractor which is responsible for text extraction.

6. The module Content Manager is responsible for management of collections, objects and licenses.

7. The second last module in the business application layer is the Cataloguing module which permits management of the content. The applicable standards will be the METS (Metadata Encoding and Transmission Standard) (responsible for encoding as well as relay specification enabling conveyance of metadata vital for management of digital objects in theKnowledge resource center).

8. The last module is the Georeferentiation module whose function is to permit referencing as per the geographical coordinates. The module will be responsible for the retrieval and storage of information based on spatial requests.

The last layer, the storage layer permits access control/access management of Knowledge resources in the Knowledge Resource Management Systems (KRMS). The Storage layer organizes the content and its metadata; user information and their access levels and the approved flow of knowledge during content insertion (Chen & Zhang, 2014; Xie & Matusiak, 2016a). Precisely, the Rational Database Management System Wrapper (RDBMS) permits the read and write access to a certain execution of a Database (The task will make use of the PostgreSQL). The module responsible for storage on the back up tool (file system) is the Bitstream Storage Manager (Chen & Zhang, 2014; Shuva, 2012). Fundamentally, the operationalization of the Knowledge Resource Management Systems (KRMS) will encompass several design modules.

The subsequent section discusses the inventive entities to be included in the Knowledge Resource Management Systems (KRMS).

4. Inventive entities of the Knowledge Resource Management Systems (KRMS)

To permit effective retrieval and management of knowledge resources with multiple representation formats, the project embraced a standard format for descriptive and administrative metadata entailing use of dissimilar languages that are barely compatible (Patra, 2017). Most importantly, well integrated tools permitting a distinct metadata management in accordance with representation formats is of importance from commencement. Furthermore, to permit inter-operability, the extension of the Knowledge Resource Management System's basic design is necessary to back exchange protocols.

The standards enabled by the Knowledge Resource Management system (KRMS) interface need integration of tools that permit apt running and methods that enable mapping among dissimilar representations of metadata actionable in standard interface. Among key inventive features of the Knowledge Resource Management system (KRMS) will be its high interactivity aspect with the User/Academic community as per their cognitive needs. The highly interactive aspects will be necessitated by inventive elements on indexing of text mined straightly from electronic content descriptions (Xie & Matusiak, 2016a). The feature will permit buildup of a search engine capable of directly handling information held in this content facilitating the applicability of semantic indexing methods. In this regard, the Knowledge Resource Management system (KRMS) will have a number of modules with features not originally enabled by Dspace.

The Web User Interface will consist of integrated features for recognition, matching graphic features, text mining features from content to Portable document format (PDF) with printed content using the ICRpad recognition platform(Osborn & Hinze, 2014). The module will ameliorate text centered lexical indexing via advanced technologies offered through Lucene as well as those grounded on cooccurrences plus semantics that are offered by DOMINUS.DOMINUS too comprises of avant garde features that enable exact reading of thought-provoking bits of electronic content. The Knowledge Resource Management system (KRMS) will therefore be able to support digital content in various formats particularly in FITS (Flexible Image Transport System) for descriptions.

The Authentication and Profiling unit will support client profiling behavior intended for service personalization. The module will make use of advanced technologies from artificial intelligence to trace interactions of each user with the service(s) making it possible to interpret specific information with regard to various dimensions such as special interests, interaction preferences, routine activities, goals and so on (Shuva, 2012). On the basis of this information, customized knowledge resources for every individual user would be provided making experiences with the Knowledge Resource Management system (KRMS) effective and more proficient.

The Cataloguing module will have conventionaltoptier metadata schemer founded on the languages of the semantic web (Shuva, 2012; Xie & Matusiak, 2016a). This will enable the user to make the most of abstract features of metadata when searching on the Knowledge Resource Management system (KRMS).

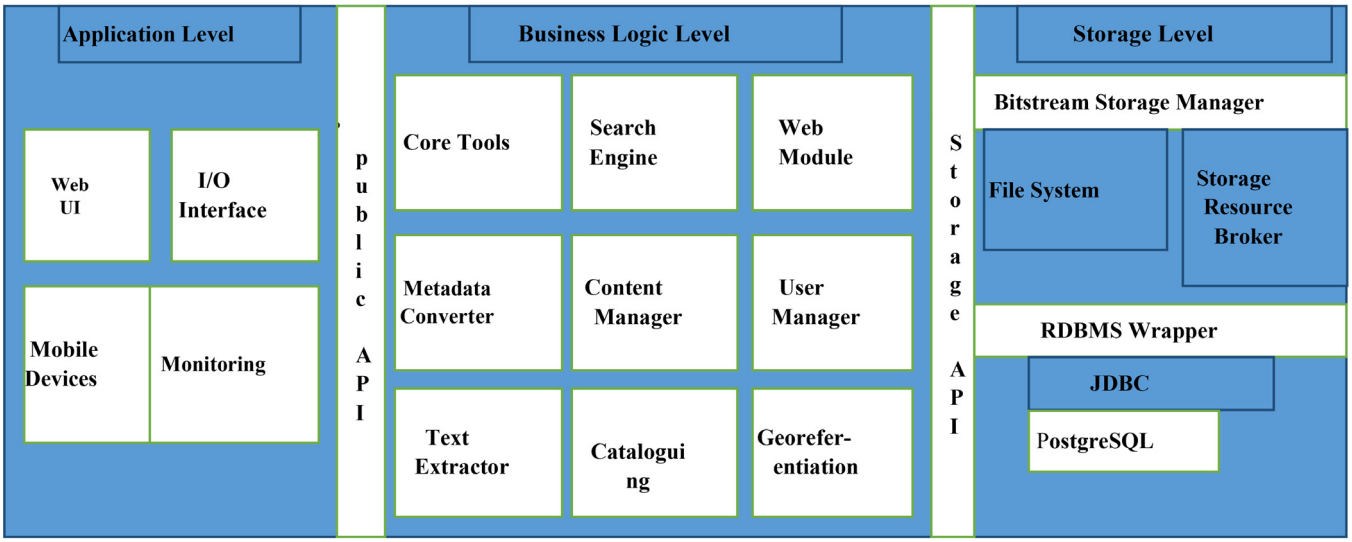

Figure 1. Figure of architecture design of proposed Knowledge Resource Management system (KRMS)

5. Conclusion

Knowledge resource centers have been identified as a critical component of the academic community in contemporary society. Similarly, technology solutions continue to briskly streamline the manner in which Knowledge resource centers store and manage knowledge resources, evolving from mere knowledge discovery places to centers of the knowledge management lifecycle society. The revolution has necessitated the need for knowledge resource centers to continue adopting cutting-edge technologies to keep up with the swelling demands of the Academic community. This study proposed an advanced Knowledge Resource Management system (KRMS) design that purposes to fill this divide by supporting complex hypermedia knowledge resources with their associated metadata. The Knowledge Resource Management system (KRMS) employs novel aspects for instance integration of the technologies responsible for handling content in all stages of information such as acquisition, text mining, indexing searches and leisure.

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