RESEARCH ARTICLE

AN EXPLORATORY REVIEW ON DIGITIZING PALM LEAF MANUSCRIPTS.

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Manuscript Info	*Abstract*
	The paper attempts to trace the innovative developments and process of digitizing palm leaf manuscripts all over the world. Palm leaf manuscripts are the evidence of cultural heritage of past era which should be preserved and passed towards future is a challenging and demanding task at present. At this juncture, an immense necessity to know the evolution of the aspects of digitization of palm leaf manuscripts in the literature. From this it could be focused for future needs and trends in the development and improvement in the task of digitizing palm leaf manuscripts. The article traces chronological development of preserving the palm leaf manuscripts in the form of digitization. Throughout the discussion high level of enthusiasm shown by the librarians towards digitization of palm leaf manuscripts as they are endangering collections all over the world.

Introduction:-

Sageer, M T K and Francis A T (2014) stated that, before the invention of paper, the palm leaves are the primary sources of writing and those were preserved all over the world. Though, it could be easily damaged by various factors, digitization is the precaution for the survival of those manuscripts. As a first step of the process of digitization, the palm leaves should under gone for collection analysis. Then only, it could be decided what, where and how the processes could be started.

Ahmed F (2009) reported that the open access system and preparation of catalogue cards revolutionized the library and its services. Now, libraries have experienced technological change in information storage and retrieval to electronic and optical media. More than traditional preservation method, the digital conversion can certainly extend the life and use of original artefact could be restricted and tools for digitization are such as hardware like a computer with configuration, scanners, digital camera and software like HTML editor, XML editor, OCR software, image editor, page layout and design software and pdf software.

Sageer T K M and Francis T (2014) mentioned that the palm leaves were main and important sources of writing before advent paper. They are available preserving in many places in world are prone to damage by many ways and hence digitization is only remedy to safeguard its contents for future use. Steps of digitization involves analysis of available collection and, how where and when digitization process starts. Before invention of paper medium for writing, world's knowledge was transmitted by scholars orally through their followers. After that, they are recorded on palm leaves and preserved for many years. Over the years, palm leaf manuscripts were perished irrecoverably and lost. Anyway, large number of collections are still preserved without any damages. In summary, the palm leaf

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manuscripts represent cultural and intellectual heritage of ancient scholars that have been transmitted orally by generation over generation and recorded permanently after many years of passing. Large number of such materials lost irrecoverably and valuable contents also lost forever due to absence of proper solution for bulk storage of data thousands of palm leaves perished through time. If there were technology, they would have save crores of valuable documents or information compared to natural and unavoidable threats to palm leaves, only remedy for preserving data on palm leaves is to convert them into digital format and the digital archiving is the commonly accepted and immediate remedy to preserve the contents in palm leaves. Digital archiving such documents solves that issue and contents can be preserved for future use and passing of time can cause deterioration of manuscript leaves and early action in digitizing the collection may lead to preservation of contents.

Understanding Digitization of palm leaf manuscripts
Vaidya B, 2010 defined that the digitization refers to the conversion of an item be it printed text, manuscript, image, sound, film or video recording- from one format (usually print or analogue) into digital. The process involves taking a physical object and essentially making an "electronic photograph" of it. An image of the physical object is captured, using a scanner or digital camera, and converted to digital form and that can be stored electronically and accessed via a computer.

Digitizing palm leaf manuscripts worldwide: globally
Ravichandran P and Narenthiran R (2016) stated that the manuscripts libraries still not able to meet basic user needs of cataloguing. The digitization of manuscripts and after cataloguing of manuscripts they should be available online and they could be preserved for future generation using the latest technology of digitization. Generally manuscript libraries may be classified into the categories are hereditary/ private collection, patronized collection and collection in research institutions.

Digitization help enormously in preserving documents and texts in their original format without the need of physical handling which prone to damage. It is a comprehensive technology where by rare manuscripts are preserved and made available to wider audience/ scholars in digital format and it has presented innumerable ways of conserving our rich manuscripts which are known as knowledge repositories. Through digitization dissemination and promotion of standards and processes must be improved. Many institutions in Tamil Nadu and Puducherry have embarked and digitized and made available online for research community. With the help of networking, one can access to resources round the clock and data transmitted in minimal duration.

The digitization of manuscripts processes from selection of manuscripts to migration of technology. It involves selection of manuscripts, preservation and conservation treatment by cleaning and applying citronella oil, digitization studio for inventory, registration, image capturing and processing, adopt the Doublin Core Metadata, store the digitized manuscript images in server/ separate hard disk and finally selected manuscripts go back to registration section to indicate that digitization is completed and handed over to library. Migration is regularly planned to utilize data according to latest technology.

Challa N P and Mehta R V (2017) reported that, in India there are many organizations or institutions committed for protection of ancient palm leaf manuscripts in order to store our precious knowledge writings. As the time passes by, the palm leaves are getting spoiled by artificial and natural elements. Author tried to develop efficient image processing system for effective retrieval of metadata automatically from these manuscripts. Among many image processing techniques some are image enhancement, segmentation, processing, restoration, compression and acquisition. Since one hundred percent correct recognition rate is impossible with noise and other distorted mediums determining right techniques for image processing is difficult so, the study contain information about some image processing techniques and algorithms applied on palm leaf manuscripts proposed by different authors for successful data retrieval.

Author concluded that, although a lot of research works exist in the field of image processing in context wit palm leaf manuscripts. But, there is a need to prepare an efficient database for the automation and digitization of these manuscripts which can be accessed by all researchers worldwide. Therefore, it is necessary to prepare an efficient manuscript database which can automatically generate metadata from palm leaf manuscripts

Devika S S and Vijayakumar K (2016) revealed that the traditional knowledge plays a crucial role in establishing sustainable relationship between man and nature in the society more dependent on natural environment for various

needs. The glorious past of Indian culture was in the inscribed manuscripts which are basic historic evidence and have enriched information value. It is estimated India possess more than five million manuscript making largest repository of manuscript wealth in the world. Thousands of manuscripts were scattered and fragmented in India and foreign countries and no accessible now. Even though, disappearing of manuscripts at alarming rate, India possesses a rich and enormous cultural heritage of manuscripts since ancient period. It's estimated that, over 3.5 million might have been presented but, 30% of remaining manuscripts are stored n temples, maths and in private hands. Author concluded that, the preservation of manuscripts through digitization is one of the effective and efficient methods but, found to be time consuming and costly exercise.

Mehta R V K et. al (2016) stated that, in order to preserve the precious knowledge ie. Palm leaf manuscripts to mankind which are being damaged by aging or due to several other reasons they have to be digitized for future use. Manuscripts being a precious base of knowledge should be protected. Image processing over the past decade has undergone various developments. Many image processing techniques have been introduced for an efficient data retrieval such as image enhancement, image segmentation and image acquisition. A transform based method which helps in enhancing digitized manuscript images. The original leaves are not in a readable form because they are aged, leading deterioration in writing media, smearing along cracks and seepage of ink, dry to leaf is also caused due to hole used for binding them. The background enhancement is needed because of the ink it's unable to force flat the leaf manuscripts and the light source for digital cameras is usually uneven during digitization which lead to poor contrast between foreground and background.

Image processing techniques such as space change detection; text line segmentation and character segmentation were used and the bottom up process for efficient data retrieval. As image quality of digitized manuscripts is not regular, it was made easy by using digitized microfilm of manuscripts rather than originals which is faster and cheaper. But, on the other hand, bad quality images were made with few grey levels because microfilm process clarifies the background and enhances the contrast and information loss occur during digitization. As there is no any proper model of layout for manuscripts the bottom up approach was chosen. In summary, image processing plays a vital role in enhancing, assessing and improvising manuscripts. There many methods to retrieve information from manuscripts efficiently. But, the cognitive memory network method using spatial change detection also gave better results extracting information from Indian manuscript as Indian language contain large character set and linguistic features.

Rattan P and Singh R (2014) mentioned that the manuscripts are such primary sources which reflect socio-cultural-historical-religious-political-economic-scientific–educational-medical- technological information of specific times beyond common tools of information. The initiatives were taken by Punjab government in preserving rest of ancient cultural treasures of times in the form of manuscripts by means of digitizing them and making accessible for researchers and for universal education and common information in general.

By the way of digitization, the cultural assets and treasures of information can be replicated, reproduced, preserved and transmitted and it will ensure the security and safety of manuscripts from further deterioration and damage and their multiple accesses by users' world over of any period of time. Also, digitization means acquiring, converting, storing and providing on information in standardized and organized format accessible through computer.

Digitization will increase accessibility of rare artefacts and provide better and enhanced lifelong services, reduce risk of further damage to already fragile sources of high demand.

Digitized copy in-fact is the back up for original material that has minimal shelf life.
The digitization processes involved are,
1. Unbind source document
2. Capture through scanner or digital camera of high quality and resolution
3. Images compressed to reduced file size.
4. Quality control.
5. Organizing before naming or numbering.
6. Subject metadata and technical metadata is created.

The manuscripts undoubtedly are the matchless possessions of ancient information which normally remains unscrutinised by information seekers mainly because these are seldom allowed a free access by its keepers. The

government must provide much needed support in terms of providing adequate funds for maintenance and un keep, technical and infrastructure support for preservation, digitization and access, skilled human resource for their careful handling, space for their proper display and use of these artefacts. An effort should be made to provide training to scholars, researchers; information seekers and keepers of manuscripts for their handling and usage through lectures, seminars, workshops, exhibitions and programmes that would cover educational institutions.

Gaur R C (2011) reported that the Indian culture lies in ancient manuscripts has glorious past. Even though large number of digitization manuscripts projects undertaken by various institutions in India digital data are vulnerable much more so, than the originals. And also, end of the digitization project great quantity of precious data were collected but, there is no institution to properly care for these data and look after the post- collection activities. Therefore, any project, a background institution should have to take responsibility for archiving data and preserving for years is a necessary condition.

Narenthiran R, Saravanan G and Ramanujam K (2012) mentioned that the digital processing and various methods and formats of preservation of manuscripts. Author reported the need for digitization as digitization provides a solution to palm leaf manuscripts problems such as conservation, preservation, accessibility and space. The most vital reason is the stored materials and documents started deterioration after certain period of time at a rapid rare.

Kumar S and Shah L (2004) stated that, in 2004 proposed a plan for digitization to save cultural heritage of India to preserve manuscripts. Every digitization programme of manuscripts should be feasible according to budget. The technical requirements need hardware, software, storage and staff. The digital capture, metadata, access should be meet international and national standards. Digitization need high quality hardware and software, lighting equipment. Software for data capturing of high quality are also costly. India's most valuable and precious gift to humanity is its profound and timeless heritage. Now, this heritage is scattered in libraries and in individual possessions and most of them are mutilated and destroyed including manuscripts. And so, preservation of cultural heritage is a great challenge and for that, merging information technology often a solution not only for preservation but also enhancement and wide scale of access.

Chhatwal A, Kanwal P and Lal P (2009) stated that, traditional libraries were transformed into digital libraries and thus national cultural heritage is preserved and accessible everywhere in the world through digitization. The digitization of manuscripts in Panjab University Library was commenced in 2004 and took decision for open archive of those vast collections.

The Panjab University Library started digitization of its collections in year 2003 as per the guidelines by National Manuscripts Mission (NMM) established by Department of Culture, Government of India with an objective to preserve, conserve and upgrade manuscripts through digitization and digitize preservation. Both national and international users make use of manuscripts for research purpose. The accessibility and success of digital technology depends on librarian, policy makers, educationist, technical personnel and institutions as well. Individual organizations can't make adequate effort. Therefore, organizations work together to prepare constructive and sustainable programmes. Digitization process is undertake by good number of Indian Libraries. These days for preservation and conservation and 24x7 accessibility. Government of India initiating efforts to preserve its cultural heritage by formulating policies and strategies at National level.

Gnanasekaran R (2017) stated about the applications of some basic filters of palm leaf texts. He mentioned that the art of writing on palm leaves is one of the oldest established medium in South India. A significant number of antiquated written works in Tamil Languages have been discovered just as palm leaves. The written panorama were found very delicate or hard to use for research and reading purposes. The digitization is the only way to read and understand well on writings. This study tries to give prologue to utilization of Adobe Photoshop filters with significant references to its applications on Tamil antiquated original palm leaf manuscripts. The basic filters include Auto-toning high definition, variation, shadowing and highlighting, Inverting and grey scaling in order to digitize the ancient texts and books for future research purposes. Through these filters it's easy to read archaic texts.
The Photoshop is most driving and prominent software programming which was developed by Adobe group and is utilized to edit various type pictures, photo and so forth. This advanced software helps to making ancient palm leaves as a readable one through digitization.

Sageer M T K and Francis A T (2015) mentioned that the endangered documents are scattered and become part of private collections, Institute collection and also part of official archives and damage rate of them are to solve this the steps should be taken to make digital library . It was explored the different attributes for organizing a digital library for endangered documents and users' attitudes towards the use and usability of the same.

Surinta O and Chamchong R (2008) reported that the palm leaf manuscripts were one of the earliest forms of written media and were used in Southeast Asia to store early written knowledge about subjects such as medicine, Buddhist doctrine and astrology. Therefore, historical handwritten palm leaf manuscripts are important for people who like to learn about historical documents. The image segmentation of historical handwriting from palm leaf manuscripts composed the process of three steps are background elimination to separate text and background by Otsu's algorithm; line segmentation and character segmentation by histogram of image. The end result is the character's image and results may be applied to optical character recognition (OCR) in the future.

Mehta, R.V.K et. al (2016) stated that, manuscripts being a precious base of knowledge which have to be preserved and to be digitized for future use. It could be protected through image processing techniques and many image processing techniques are available for an efficient data retrieval such as image enhancement, image segmentation and image acquisition.
The image processing plays a vital role in enhancing, accessing and improving manuscripts. Even though many methodologies available they are failed to receive efficient data retrieval for Indian languages as it contains large characters and linguistic features. Therefore, in those cases the cognitive memory network method using spatial change detection also gave a better result in extracting the information from an Indian Manuscript.

Kurnia B I P A and Sudarma I B K (2017) stated that, the Balenese lontar manuscript as a documentation medium is highly vulnerable to rodent insects and high humidity levels and therefore the development of digital technology provides benefits in the preservation of manuscripts through digitization. Digitalization of manuscripts can preserve information and knowledge in the lontar palm leaf into digital form. However, much later emerged obstacles and other challenges in the process of managing the digital manuscript such as lack of human resources. The biggest problem is that people cannot use the digital manuscript because of the language and script used in the palm leaf manuscript and therefore decreasing the knowledge and ability of the communities to read the manuscript occurs. The influence of globalization and modernization on the cultural life of the Balinese peoples led to the cultural entropy on the effort to preserve the lontar manuscript.

The conservation and preservation is no longer the work and its essential to build an awareness of keeping the traditions of Balinese lontar manuscript and it was done through the lontar festival. This activity can improve utilization and access to the manuscript, either physical or digital form. And thus, the manuscript digitization activities can be beneficial to the community. In the future, the manuscript preservation program can be a program that is more inclusive, synergistic and integrative.

The main key that can make lontar manuscripts still exist in the community is to provide accessibility and knowledge of lontar to the every community member widely. With open access and supported by efforts to re-popularize the tradition of lontar, cause the community will feel close and have a sense of responsibility to maintain its sustainability. Because the preservation and conservation activities of lontar manuscripts can not only rely on technical matters, such as cleanliness and the lontar storage method, as well as by digitizing to preserve lontar information into digital form. It takes humanistic efforts, by bringing together the manuscript lontar with the community. Re-popularization of reading and writing traditions is the best way to maintain the existence of the lontar and its information and knowledge in the community. Because it needs to realize that the lontar is different from other texts. Society needs to understand the language and the script used in the palm leaves. The education and access to knowledge to bring people closer to the lontar be a good approach to maintain the sustainability of the tradition of reading and writing palm leaf manuscript in Bali. Because not always the library can handle the entire manuscript in the community. Peoples need to know and understand about the collection of manuscripts it has, in order to arise a sense of belonging to jointly preserve the cultural heritage as a cultural identity.

Qutab S, Bhatti R and Ullah F S (2014) reported that in Pakistan, many institutions and personal libraries hold a good collection of manuscripts. After 67 years of independence, among many other neglected areas, manuscripts are most neglected one in Pakistan. Manuscripts were conserved and cared since old times but, there were no methods to preserve them or at least safe their contents forever. It's only becomes possible with invent of technology.

Fascimiles, microfilming and now digitization is in practice for this purpose. Digitization is increasingly used as a technique to allow access to content without risking the original materials. Digitization not only help of the preservation of manuscriptsbut also, solve the issuesrelated to its cataloguing, access, distribution and research. Manuscripts are being digitized worldwide to provide user friendly interfaces, open and easy access and detailed search. It was found that, the overall conservation of manuscripts is not satisfactory in Pakistan. Only preventive conservation was performed on regular basis, curation and restoration are very rare. On the other hand, none of digitization practices was upto mark but, it is worthwhile that somehow the process of digitization has been started. However, need for awareness, proper training, bench marking and planning is needed. The digitized materials are also still within institutions without OPAC (online public Access Catalogue) and repositories to increase visibility and research.

Ahmed F (2009) reported that, digital conversion will extend the life of artefact and use of original document could be restricted and therefore, the digitization will enhance access to artifacts. And also he mentioned that, there are two types of manuscripts which are paper and palm leaves and in Osmania University Library paper and palm leaf manuscripts digitized. The processes involved were, the deteriorated manuscripts are treated and mechanically cleaned and applied citronella oil to make clean image, register maintained for digitizing manuscripts and scanning the manuscripts.

Gyi, H.H. (2016) reported that, librarian is responsible for creating, storing and digitizing palm leaf manuscripts for the users and palm leaf manuscripts are cultural heritage and wisdom records of rare collections. The study focused on digital preservation and creating database of palm leaf manuscripts. Author concluded that, palm leaf manuscripts are cultural heritage of Myanmar and have to preserve manuscripts to cover the diverse subjects such as astronomy, mathematics, medicine, literature, history, astrology and scriptures. By digital preservation of palm leaf manuscripts which are to be easily accessed and searched by researchers and scholars through author, title, subject and general keywords.

The document analysis comprises spatial change detection, text line segmentation and character segmentation. The challenge of separate foreground text from background and separating lines and characters were found and it was rectified by using binarization technique, spatial change detection, computing histogram column wise, row wise and applying threshold. Spatial change detection was done by binarization techniques but, doesn't show effectively and therefore, cognitive memory network was done for spatial change detection.

1. Textline segmentation : separate each line from image. Histogram is rowwise and with threshold it is enabled to separate the lines.
2. Character segmentation: compute histogram columnwise and apply threshold which create separation between characters. To segment characters, selected pixel regions change from black to white and white to black.
3. Metadata retrieval: Author proposed image analysis system to retrieve metadata.During this, various morphological operations were done.

The study the feasibility to process automatically digitized manuscripts by using generic platform in order to retrieve information from the manuscripts. Bottom up process was done for efficient data retrieval. Image quality of digitized manuscript was not regular.

The location of maintext of the layout in the given manuscript is very important issue because classification of objects may change basing on the positioning. The recognition of several metadata is based on the features such as colour, shape and geometry.

Image processing plays a major role in enhancing, accessing and improvising manuscripts. Many methods proposed by various authors but, still many of them fail miserably in case of Indian languages as it contains large character set and linguistic features.

The cognitive memory network method using spatial change detection also gave better results in extracting the information from an Indian manuscript.

Digitization of Palm Leaf Manuscripts in Sri Lanka
The University and special libraries in Sri Lanka have started digitization process to a certain extent. Digitization and building digital libraries are leading in library field in Sri Lanka. Though there is a trend to create digital collection, study shows that there is no national policy for Library material digitization in Sri Lanka. It's a major

barrier when digitization projects handling in national wide. Though individual libraries and institutions have their own policies but, those are differing from one to one.

Ranasinghe P and Dilruk W M T (2013) mentioned that, manuscripts in 40 temples and 05 private collections were examined and mo0re than 100,000 pages were digitized. The Project is entirely funded by Faculty of Social sciences, Kelaniya. A website was developed and digitized database of manuscripts will be online in due course. D Space software with doubling core metadata standards were done.

Summary and Future Inclinations

The palm leaf manuscripts are the sources of cultural heritage of our ancestors. It is a very crucial part of the librarians or archivists or curators to conserve and preserve them to pass the information and knowledge to successive generations. In all over the world there many countries especially South Asian countries put much effort to preserve them for future. One of the potent methods of preserving those endangered documents like manuscripts are digitization. In future there should be more cooperative plans to preserve them by joining through the national or international projects.

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