Eliciting and Modeling the Requirements for an Online Data Archival Management System

[1]Emmanuel O.C. Mkpojiogu, [2]Gerard Efe Akusu, [3]Azham Hussain,
[4]Wahidah Hashim

[1,3]School of Computing, Universiti Utara Malaysia, 06010 UUM, Sintok, Malaysia
[2]Department of Computer and Information Technology, Veritas University, Abuja, Nigeria
[4]Institute Of Informatics And Computing In Energy, Universiti Tenaga Nasional, Malaysia.
[3]azham.h@uum.edu.my

Abstract

Information is an integral part of any person's or organisation's life as important decisions are made based on them. As such there is a need to properly store/achieve, manage and easily retrieve important and sensitive information when necessary. However, the use of papers and manually sorting, storing, searching, retrieving and moving files is tedious, time-consuming and not very efficient. The purpose of this study is to elicit and model requirements for a data archival management system to be used in Veritas University, Abuja. The system when implemented will solve a good number of the complications involved in manually archiving and managing files in the institution. The requirements elicitation was carried out via interviews while the requirements modelling were done using UML.

1. Introduction

Data is one of the most essential building blocks of any establishment. It is referred to as the "life blood" of an organization as it flows between systems, databases, processes, and departments. It carries the ability to make the organization smarter and more effective [20]. Now as an organization continues to grow and function there are certain information that will be stored; not necessarily to be used in the near future, but due to their level of importance to the organisation [29]. This storing of important data for long-term retention or referencing is called Archiving [23-24]. For a long period of time, the archiving of information has been done manually, where most of the data are in hardcopy and are kept in a particular physical space [22]. Although this has been working, it takes time and energy to sort and arrange the data that are to be stored and sometimes still leaves a couple of inaccuracies, it also leads to unnecessary exhaustion of useful resources [8]. As earlier mentioned, data moves within an organization and sometimes even between organizations, this movement of data from one place to another is also time-consuming, exhausting and prone to insecurity as the hardcopy of the information has to be physically moved by a designated person [28].

Creating a system that archives and manages data solves a good number of the problems involved in manually carrying out this work [9].

This project attempts to solve these problems by building an online Data Archival Management System. The system will consist of an admin end and the user end. The user end will consist of two parts: the super users and normal users. The admin end will allow its user create and input certain data (users, department, folders, references and so on) necessary to sort, archive, search and retrieve files and also transfer data from one user to another. The user end will allow its user gain access to view, search, retrieve and transfer archived data to another user, thus creating a paperless environment. Super users will have more privileges than the normal users, for example, a super user will have the ability to create references and folders for archiving data while a normal user will only be able to view the created reference and use it. An example of a super user is a secretary as most of the information pass through that office and an example of a normal user is a lecturer.

An archive is an accumulation of historical records or the physical place they are located. Archives contain primary source documents that have been accumulated

over the course of an individual or organization's lifetime, and are kept to show the function of that person or organization [29]. The archives of an individual may include letters, papers, photographs, computer files, scrapbooks, financial records or diaries, created by the individual in any media or format. The archive of an organization (such as corporation or government) has a tendency to retain and organize other types of records i.e. administrative file, business records, memos, office correspondence and meeting minutes [29]. Generally, an archive consists of records which have been selected for permanent or long-term preservation for their historical value, enduring research value, operational needs and risk of content loss [29]. Professional archivists and historians generally understand archives to be records that have been naturally and necessarily generated as a product of regular, legal, commercial, administrative, or social activities [7]. Data archiving is the process of moving data that is no longer actively used to a separate storage device for long term retention and preservation [23-24] and it is essential for organizations that accumulate new information but still need to retain older information [12]. Now, data management on the other hand is an administrative process that includes acquiring, validating, storing, protecting, and processing required data to ensure the accessibility, reliability, and timeliness of the data for its users [14]. It is the practice of organizing and maintaining data processes to meet on going information lifecycle needs [14]. Emphasis on data management began with the electronic era of data processing, but data management methods have roots in accounting, statistics, logistical planning and other disciplines that predate the emergence of corporate computing in the mid-20th century [23-24]. The practise of archiving and/or managing data is very old and dates back to the third and second millennia BC. After 1066, England developed archives and archival research methods. The Swiss also developed archival systems after 1450. However, modern archival thinking has many roots from the French Revolution with the French National Archives created in 1790.

Over the years the methods of data archiving and managing have evolved from storing and moving information physically in hardcopy to digitally doing so. In recent times web-based systems or applications have been developed to archive and manage data [18]. Archivematica, a popular web-based system, originally referred to as "Qubit-OAIS", is a free and open-source digital preservation system that is designed to maintain standards for long-term access to collections of digital objects [15]. It was developed by Artefactual Systems in part through funding from UNESCO [15]. Archivematica is packaged with the web-based content management system AtoM for access to digital objects [4]. It provides an integrated suite of free and open-source tools that allows users to process digital objects from ingest to archival storage and access in compliance with the ISO-OAIS (International Standard Organisation Open Archival Information System) functional model and other digital preservation standards and best practices [4]. The latest version of the system is Archivematica 1.7/Storage Service 0.11 released May 2018 [2], it uses a simple web-based graphical user interface to accomplish operations, The web dashboard allow users to process, monitor and control the Archivematica workflow processes. It is developed using Python-based Django MVC framework. The Dashboard provides a multi-user interface that reports on the status of system events and makes it simpler to control and trigger specific micro-services. This interface allows users to easily add or edit metadata, coordinate AIP and DIP storage and provide preservation planning information [4]. It also implements a micro-service approach to digital preservation. The Archivematica micro-services are granular system tasks which operate on a conceptual entity that is equivalent to an OAIS information package: Submission Information Package (SIP), Archival Information Package (AIP), Dissemination Information Package (DIP). The physical structure of an information package will include files, checksums, logs, submission documentation, XML metadata, etc. [4]. It may be installed directly on a Linux system, and specifically targets long term support releases of the Xubuntu operating system. It is also available in the form of virtual machine images that may be run via VMWare, VirtualBox or KVM, which between them may be run on Windows, Linux, Macintosh, or Solaris [11].

Veritas University, an academic institution of higher learning based in Abuja, Nigeria, started operating in 2007 at Obehie and later relocated to Abuja in 2014. A good number of students have enrolled, staff employed and other administrative developments have occurred in the university and are still occurring till date [26]. As part of the enrolment process for students, there are certain documents that the students have to present; like birth certificates, secondary school certificates and results etc., which are then collected and filed. Even when the student has been enrolled, documents like clearance form, course form and so on are usually collected, filled, submitted and filed periodically. Also, when students are given assignments and projects, the submission is usually written or printed in hardcopy. On the administrative side, there are documents also that need to be filled, signed, sent to the appropriate offices and filed, be it financial documents, legal documents etc. Basically, the University still largely uses hardcopy and file cabinets for disseminating and storing information.

It is however amazing to see that in this fast evolving digital age and time, most institutes and organizations still heap papers in a room or designated space [5]. Looking at the immediate environment where this research project is carried out, the researchers observed that Veritas University, Abuja practically lacked a physical archive, except for the library and of which, has its own primary function, yet most files and documents both old and new are still printed. File cabinets are still in use for new documents, which begs questions like; where are most of these very important documents that are not

currently or frequently used actually kept?, if there is an actual archive space in the institution, how safe is it from weather, rodents, theft, fire and other factors that can destroy the documents? Since data continually increases in an institution like this, what level of ease or process is involved in sorting, storing, browsing and retrieving these data when needed? Due to these rationales, an Online Data Archival Management System proves it will play an important role in improving the academic efficiency in this institution and any other organization that lacks an archive or even still uses physical archives [25].

The proposed system to be developed differs from existing systems like the Archivematica system and other prior archival systems, in the sense that it does not only offer long term maintenance and preservation of digital data, but also allows direct transfer of data from one user to another through the system, ensuring information confidentiality and also allows data to be managed, that is, accessed, validated, stored, protected, and processed and ensures the accessibility, reliability, and timeliness of the data for its users. It integrates the functionalities of both a data archival system and a data management system into a single system. Also the use of this system and its overall functionalities will aid in the creation of a more or less paperless environment in an institution or organization.

Manually sorting, archiving, searching, retrieving and moving data, as earlier stated, is tedious. It involves a considerable amount of time, exhausts human energy, uses up an unnecessary amount of resources like paper clips, papers and printing toners which in turn cost money, like cost of maintenance for the printers, cost of printing and taking up of space [19]. When the hardcopies of file are archived physically, there is the possibility of the information being destroyed by rodents, natural disasters, theft and with time, the information will no longer be readable and usable, hence the loss of valuable information [21]. Also searching and retrieving the hardcopy of a file takes up time and due to human natural imperfection, one can miss a file when searching and assume it not being there at all. Also productivity is lowered by having to spend excessive time trying to access a particular file [8]. From the researchers' personal encounters, in Veritas University, there are times when corrections will be made on a document, after being printed and submitted to a particular office, the document will then have to be edited and reprinted, leading to wastage and extra cost. Other times, sending information from one part of the institution to the other, manually, is somewhat stressful and at times, the information ends ups not reaching the intended destination and sometimes some documents can end up not being attended to or get missing in the process due to human error.

Furthermore, after a study of a number of prior research works and systems done, a couple of gaps were observed by the researchers, for example the quick search functionality feature in some systems either do not produce precise results or were non-existent [1]. The retrieval of archived data is not very efficient, in the sense

that full or complete information of archived data are not always available to users. Sharing of information is still done in such a way that when a file is uploaded into the system for archiving, it is available to any and every other user of that system [30]. Security of some systems is another issue, where security measures are not firmly implemented to protect the confidentiality, integrity and authenticity of data and also to provide access privileges and restrictions between different types of users [13]. The problem this project is confronted with is mainly to greatly reduce the use of hardcopy files and documents when it comes to transferring and archiving data, the wastage of useful resources, time and energy and also to make the data readily available and easily accessible by those authorized to have the information [17]. Archivo 1.0, the system this research project aims to develop, will attempt to fill the mentioned gaps by improving the security, data retrieval and quick search functions and also implementing the function of direct user to user file transfer.

The aim of this project is to elicit and model requirements for the development of an online Data Archival Management System, particularly tailored for Veritas University, Abuja, to computerize the archival of data and create an easy way of sorting, archiving, viewing and retrieving data when needed and also create an easier method of transferring data from one department or user to other in the institution, thus, creating a paperless environment using the same system. The specific objectives of this system project include: i) To elicit requirements for the design of an archival management system; ii) To design an archival management system for subsequent implementation. The research questions that guide this study include: i) How can the requirements for the design an archival management system be elicited? ii) How are the requirements modelled and how can the archival management system be designed?

This study is significant to a large extent. The results of this project will make important contributions to existing literature on data archival systems as well as data management systems as it will attempt to improve on previous researches carried out and address the constrains or gaps of prior developed systems in terms of data retrieval efficiency, security, direct data transfer and other functionalities like quick search. Theoretically, the tools and precise steps used and taken to develop the Data Archival Management System as a single system and to address these gaps will be stated. Thus, the contents of this paper will serve as a reference to subsequent papers that will be written by other researchers on similar systems. Practically, in Veritas University, Abuja, this study will also be of great significance as it will ease an aspect of the work load on administrative hands. Users of this system will hardly need file cabinets, shelves or a large physical space to store documents and files, also, large amounts of files will be stored for a long period of time without any form of data loss. The complications involved with manually browsing through papers to get a particular document will be eliminated as the system will

aid quick search through references and/or keywords. The need to physically move around to disseminate files will be eliminated, it will also make editing of documents easier, in the sense that if a document still has to be printed, it can be first sent to the intended destination for all the corrections to be stated and made before finally being printed. There will be less use of papers and other resources, thus an increase in efficiency and reduction of wastage will be ensured. Files or data will be readily available when needed and easily retrieved. It will also reduce the amount of unauthorized access to information. The system itself will be an integration of two systems, that is, Data Archival system and Data Management System to make a single coherent system, thus, reducing the cost of acquiring two systems and still achieve the general goals of both. Generally, the results of this research project will be beneficial to researchers and designers carrying out similar works and organizations/institutions that either do not have archives or still physically store files.

This paper is organized as follows: having introduced the research project in section 1, section 2 will take care of the methodology of the study, section 3 will handle the results and finally, section 4 will round up the paper with a conclusion and future work.

2. Materials and Methods

This section addresses the protocols, methods and materials employed in this study.

System Development Process: The system development protocol used followed waterfall model while the requirements modeling was carried out using UML modeling process.

Requirements Capturing: Two methods were utilized in eliciting requirements for the project: in-situ interviews and requirements reuse [3][6][10][16[[27].

i) **In-situ Interviews:** this elicitation was done on site by orally asking a key staff the university, who deals with the storing and/or managing of the files in a department, using the one-on-one, structured interview method to capture what might be required of the system.

ii) **Requirements reuse:** this is a common method of requirement elicitation; it involves making use of already used requirements of existing systems. After a study of related works, the common requirements used by most of the systems were selected and used for the design of the proposed system.

Design and Modelling: The modelling of requirements and design of system was carried out using UML.

Unified Modelling Language; a diagrammatic object-oriented modelling language that enables designers to specify, visualize, construct and document artefacts of a software system. It uses graphical notations to express the modelling of requirements and the design of software. UML diagrams are most suitable for modelling the system, because the PHP language (to be used in the

implementation) is also object-oriented. The models of the proposed system were expressed using the following UML diagrams:

i) **Use case diagram**: this is a behavioural diagram in UML used to model the functionality of a system using actors - people or entities operating under defined roles within the system, and use cases - a set of actions, services, and functions that the system needs to perform. The actors of the proposed system are Heads of Departments, secretaries, lecturers, and any other authorized file handling/managing personnel.

ii) **Activity diagram:** this illustrates the dynamic nature of a system by modelling the control flow from activity to activity. An activity represents an operation on some class in the system that results in a change in the state of the system. Typically, activity diagrams are used to model workflow or business processes and internal operation.

iii) **Sequence diagram**: also known as event diagrams, describes how, and in what order, a group of objects works together. This diagram is used by analysts, and designers to understand requirements for a new system or to document an existing process. Sequence diagrams are sometimes known or event scenarios.

3. Results

In this section, the results obtained from the interview are given and used to develop the requirements for the proposed system. The system was designed and modelled according to the developed requirements using UML diagrams.

Requirements Development: Requirements development is a set of activities that produces requirements for a system. It commences with requirements elicitation and leads to requirements modelling.

Requirement capturing: One of the methods used to elicit requirements was the in-situ interview method. A set of questions was constructed and administered on site to a staff of Veritas University. In the course of interviewing the key staff, the researchers noted the answers given by the staff. The results of the interview, corresponding to the questions asked, are given below:

i. Please explain the process that takes place when a new set of documents is brought to you?

"I would look at the document(s) to see what it is intended for and to whom or where it should go to. Whatever is to be done with the document will be done, but if the document is to be kept for the department, then it will be kept in the appropriate folder in the department's file cabinet, like filing students course forms."

ii. Would having a system to create different folders to store related documents be of much use?

"That would help."

iii. What is the process involved in retrieving a file?

"It depends on what file is needed. once I know what file I need to bring out I just go the cabinet and look through the folders, as you know all folders carry names, and once I see a folder with the name where the file I am looking for is most likely to be in, I then go through that folder and pick out what I need."

iv. Would having a system to search and access folders using the folder name or reference be of much use?

"Yes, it will be useful."

v. Would you like all documents to be stored and managed using this system?

"Well we don't have such yet but if it is possible and except in situations where the hardcopy files are necessary, yes."

vi. Do you sometimes need to correct or edit a document before storing or sending it to another office?

"Not very often"

vii. If a document is in the form of hardcopy, do you have a means of making it digital? If yes, how?

"Yes we can scan the documents."

viii. Would you rather have documents transferred electronically?

"That would relieve me of the need to go and collect some the files myself. This will be very useful. Except in very necessary hardcopy demanding situations, yes I would."

ix. Documents come from various offices and staff in the institution, would having a system that allows you to create the specific users that can view documents on the system and the specific users that can transfer data to you be necessary and useful?

"Yes. But you know that not just anybody is allowed to see every document, even if they are allowed to transfer documents to me."

x. Being presented with the idea of having a system to assist in your work, what features or functionalities would you like the system to have exactly?

"Well from what we have been saying, I think that if all files are going to be in softcopy, then they should be secured and I should be able to get them at will. Then only people in this department should be able to see certain files, if anybody wants to get certain files they have to come to me. I also should be able to send files to people and not just them sending to me. I think it should also be able to store pictures as well, because there are some files that would require passport photos."

xi. Does the institution have a specific type of computer system that all staff must use or are staff allowed to use any computer?

"Not really. The school provides official desktop computers but staffs still use personal laptops to work."

xii. Do you think it would be best if the system only worked within the institution's intranet or not?

"I would say over the internet, just the way the school's website is, but looking at it that since it is not general information that will be kept there, then making it within the school will be good too."

Software Requirement Specification (SRS): A full and clear understanding of requirements helps the designers design developer build the right system and software requirements specification helps lay the foundation of the system to be developed. SRS describes what the system will do and how it will be expected to perform, that is, it describes the functionality the system needs to fulfil all that the end user needs. After the interview and a study of prior systems to see what features and functionalities the user require and the commonly implemented ones, two types of requirements were captured for the proposed system:

- **Functional requirements:** these refer to processes/services the system is expected to perform. The functional requirements of this system include the following:

  i. User authentication: every user must login before having access to any feature or information on the system.

  ii. User management: the overall administrator of the system should be able to create/register users on the system as either super users or normal users as well as view and delete created users from the system. The administrator should be the only user able to do this.

  iii. Department management: the administrator should be able to add and delete departments for the system.

  iv. Upload and download of files: users should be able to send digital copies of file into the system. When a file is uploaded into the system, for whatever reason, it should be easily retrieved/ downloaded by users at any point in time.

  v. File management: users of the system should be able to view, archive, transfer and/or delete uploaded files.

  vi. Archival of files: the system should have a database capable of storing files over a long period of time.

  vii. Quick search: users should be able to access files by searching for the file, using keywords or the folder of the file. The search function should produce accurate results.

  viii. File transfer: once a file is uploaded into the system, users should be able to directly transfer it to another user of/on the system.

  ix. File editing: when necessary, the system should allow user be able to open files that are on the system and manipulate and edit the information they contain.

- **Non-functional requirements:** these are requirements that define the qualities of a system like the effectiveness of a system, they are not provided by the system but affect the functions provided by the system. The non-functional requirements of the proposed system are as follows:

i. The system must be accessible from any computer within the university's Intranet.
ii. The system should run on any web browser and on any computer system.
iii. The system should always be available and accessible and retain all data archived in it.

iv. Access should be limited to the system's administrator and user created by the administrator.
v. Access and privileges should be given to the users of the system according to their user type.

Design and Models: The requirements models are as follows:
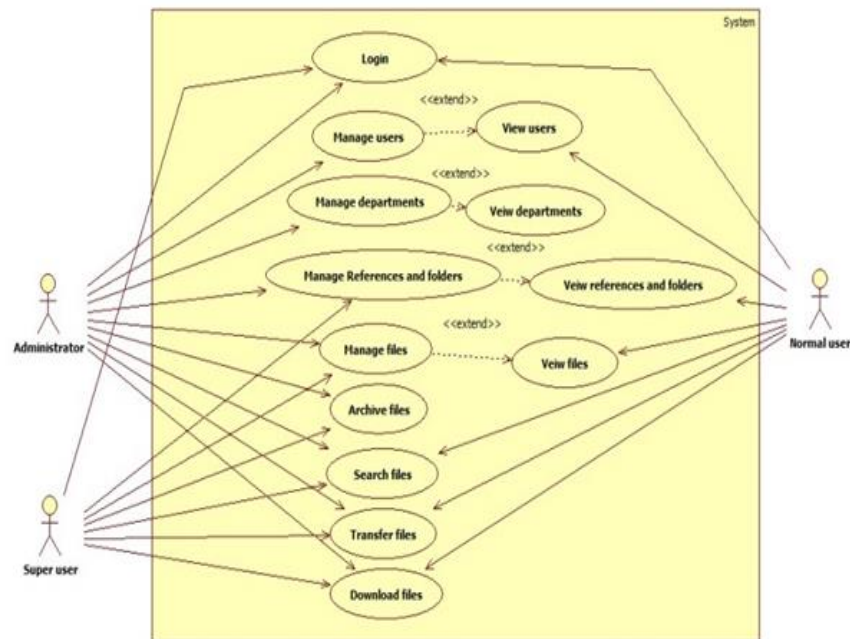
Figure 1: Use case diagram of Archivo 1.0
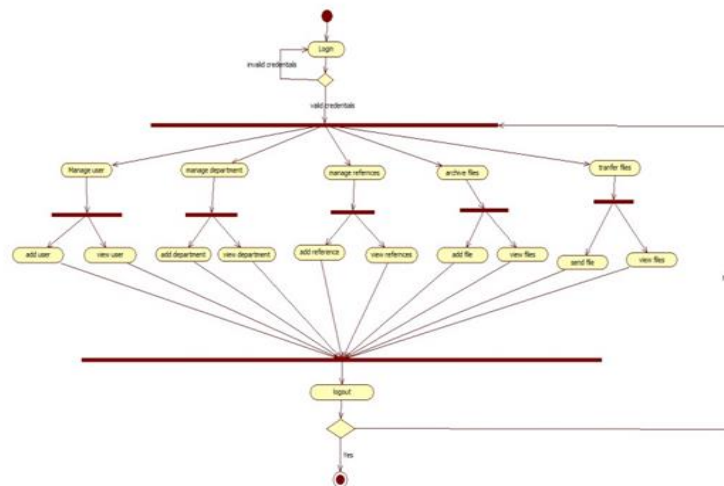
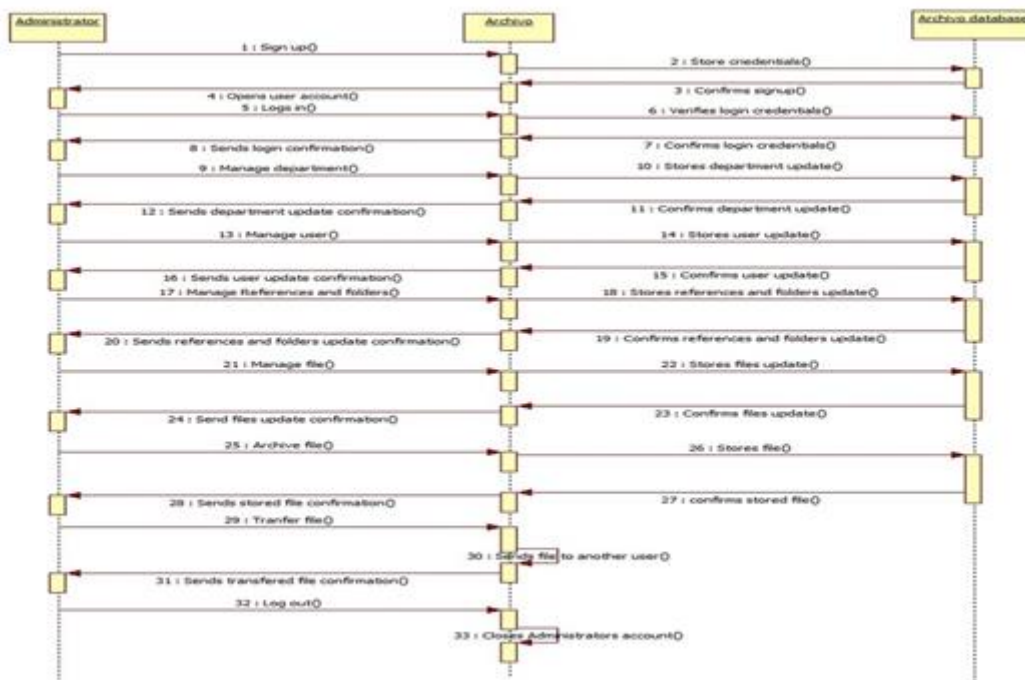Figure 2: Activity diagram of Archivo 1.0

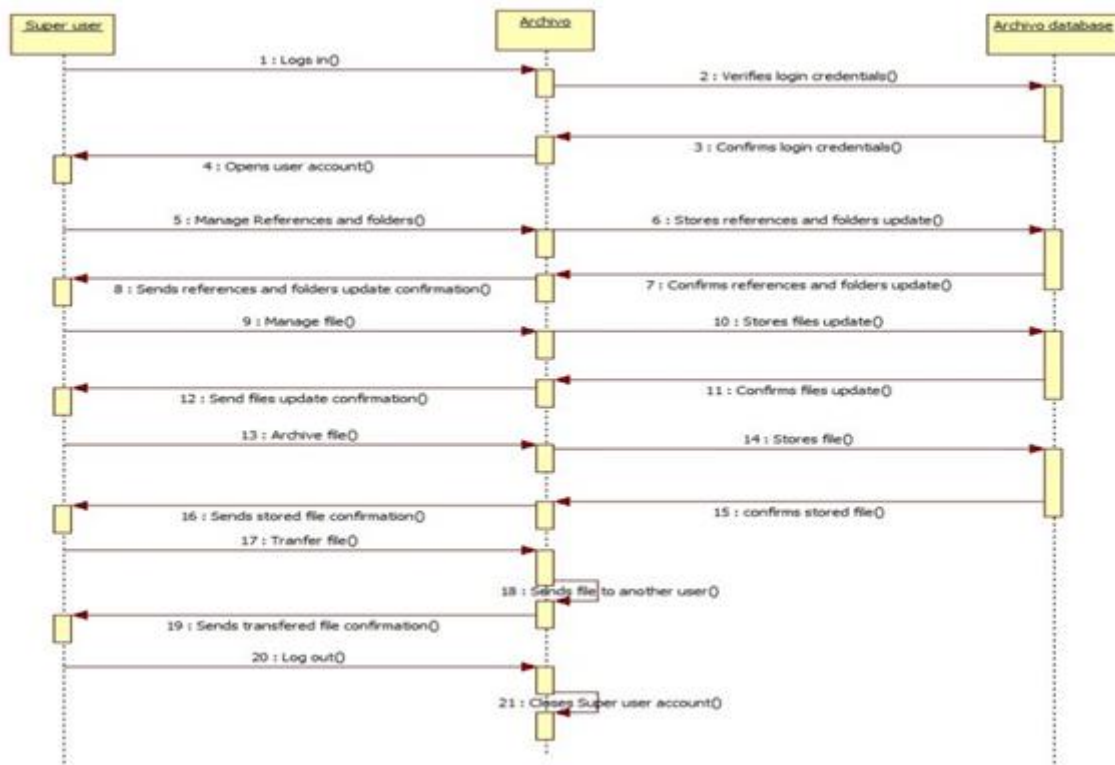Figure 3: Sequence Diagram for the Administrator end of Archivo 1.0

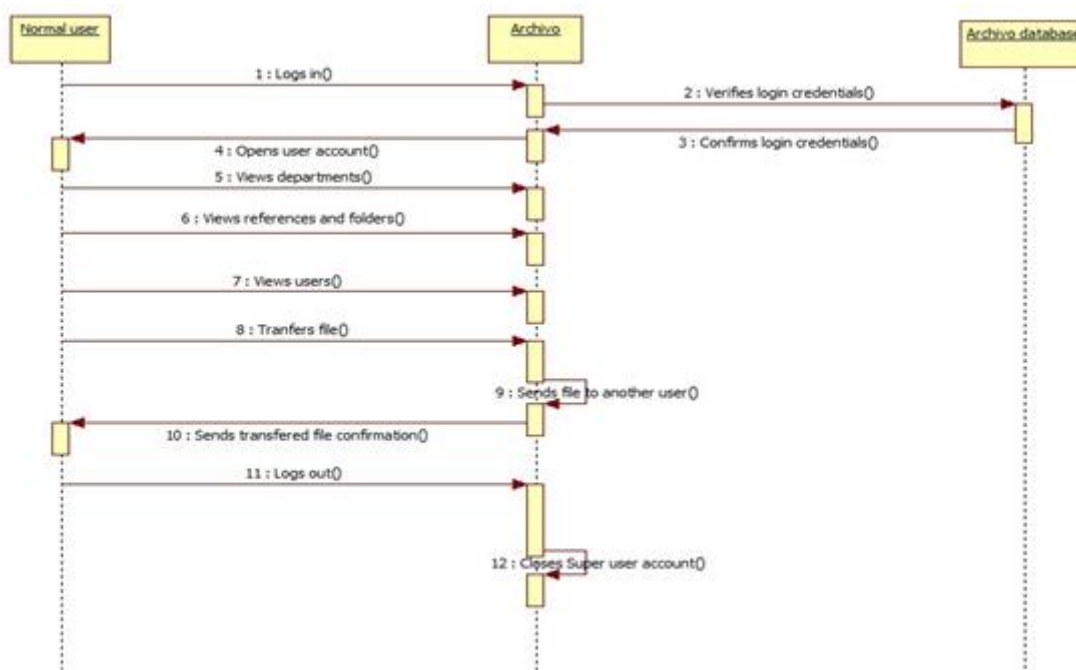Figure 4: Sequence Diagram for the Super User end of Archivo 1.0

Figure 5: Sequence Diagram for the Normal User end of Archivo 1.0

4.   Conclusion

This study elicited and modelled requirements for the development of an online web-based data archival management system for Veritas University, Abuja. The system was designed primarily to handle the long term storage and management of files in the institution as well as improve on already existing systems by implementing the feature/function of direct file transfer from one user to another. To the best of the researchers' knowledge as of the time of this study, no such system exists a priori. Following the gathered requirements, the proposed systems requirements were modelled. In the future, the requirements models would be implemented to give birth to the data archival management system, ARCHIVO 1.0.

References

[1]   Aadamsoo, A. (2010). *Web Based Project Management System* [Scholarly project].Retrieved June 29, 2019 from https://www.theseus.fi/bitstream/handle/10024/16996/Aadamsoo_Anne-Mai.pdf

[2]   Archivematica.org (May 2018). Archive matica 1.7 and Storage Service 0.11 release notes. Retrieved July 20, 2019,from https://wiki.archivematica.org/Archivematica_1.7_and_Storage_Service_0.11_releas_notes

[3]   Hussain, A., Shamala, P., & Mkpojiogu, E.O.C. (2019). The effect of software features' perceived importance on the observed performance of software product qualities. *Journal of Advanced Research in Dynamical and Control Systems (JARDCS),* 11(08-SI), 1076-1082.

[4]   Archivematica.org (2017). What is Archivematica?. Retrieved July 19, 2019, from https://www.archivematica.org/en/docs/archivematica-1.9/gettingstarted/overview/intro/#

[5]   Arekete, S.A., & Adewojo, A.A. (2013). Design of a Prototype Web-Based Students'Record Management System – WEBSTREMS *Journal of Information & Knowledge Management*, 3(5) 2224-896X.

[6]   Hussain, A., Mkpojiogu, E.O.C. & Kutar, M. (2019). The impact of software features' perceived importance on the perceived performance of software products' quality elements.. *Journal of Computational and Theoretical Nanoscience.* 16 (5-6), 2135-2140.

[7]   Aliyu, M., Bola, Y., Tunde, I., & Owolabi, R.S. (2018) Archival Records and Manuscript Collections in Selected Polytechnic Libraries in North-Central, Nigeria. Retrieved May 12, 2019, from https://www.questia.com/library/journal/1P42164442098/archival-records-and-manuscript-collections-in-selected

[8]   Bowers, K. (2017). The Disadvantages of Manual Document Filing Processes. Retrieved June 23, 2019, from https://blog.mesltd.ca/the-disadvantages-of-manualdocument-filingprocesses

[9]   Dalle, R. (Sept., 2018). What are the characteristics and advantages of a digital archive?. Retrieved July 23, 2019 https://www.docbyte.com/blog/what-are-the-

characteristics-andadvantages-of-a-digital-archive

[10] Hussain, A., Mkpojiogu, E.O.C., & Nawi, M.N.M. (2017). Capturing customer satisfaction and dissatisfaction in software requirements elicitation for features in proposed software systems. *Journal of Engineering and Applied Sciences (JEAS)*, 12(21), 5590-5597

[11] Archivematica (July, 2015). Archivematica". Retrieved July 19, 2019, from http://www.dcc.ac.uk/resources/external/archive matica

[12] Dell Technologies (2019). Retrieved June 9, 2019, from https://israel.emc.com/glossary/detail.htm

[13] Fiona, A.C. (2010). Development of a Data Management System For Students' Final Year Projects Case Study: Department of Information Systems [Scholarly project]. Retrieved May 5, 2019 from http://103.23.20.161/index.php/semnasif/article/view/1196

[14] Galetto M., (March, 2016). What is Data Management?. Retrieved June 23, 2019, from https://www.ngdata.com/what-is-datamanagement/

[15] Garderen, P.V., Jordan, P., Hooten, T., Mumma, C., .& McLellan, E. (2012) The ArchivematicaProject: Meeting Digital Continuity's Technical. Retrieved June 23, 2019, from http://www.unesco.org/new/fileadmin/MULTIM EDIA/HQ/CI/CI/pdf/mow/VC_VaGarderen_et_al_26_Workshop1.pdf

[16] Mkpojiogu, E.O.C. & Hashim, N.L. (2017). Evaluating the effectiveness of scoring rubrics assisted reading (SRAR) technique in the reading of software requirements work documents. *Journal of Engineering and Applied Sciences (JEAS)*, 12(21), 5548-5553

[17] Ionos.com (2016). Paperless office: can you really digitize everything? Retrieved July 23, 2019, from https://www.ionos.com/digitalguide/online-marketing/online-sales/paperless-office-the-advantages-of-digital-archiving/

[18] Jordan, L.B. (2012). *Getting Personal: Confronting the Challenges of Archiving PersonalRecords in the Age* [Scholarly project]. Retrieved July 23, 2019, from https://pdfs.semanticscholar.org/8813/acd668c16 7eba14e63d46690ef74d5157fc0.pdf

[19] Kajal, J.J., Deepika, S.T., Neil, G., Parth, M. & Harsh, B. (2015). Data Archival using Hadoop Distributed File System. International Journal of Computer Science and Information Technologies (IJCSIT) 6 (6), 4974-4976. Retrieved from http://ijcsit.com/docs/Volume%206/vol6issue06/ijcsit2015060626.pdf

[20] Mitre.org (2019). Information and Data Management. Retrieved June 29, 2019 from https://www.mitre.org/publications/systems-engineering-guide/enterprise-engineering/enterprise-technology-information-and-infrastructure/information-and-data-management

[21] Nationalarchives.gov.uk (n.d). Archive Principles and Practice: an introduction to archives for non-archivists. Retrieved July 23, 2019, from http://www.nationalarchives.gov.uk/documents/a rchives/archiveprinciples-and-practice-an-introduction-to-archives-for-non-archivists.pdf

[22] Postma, C. (2018). Archive Storage Options And Safeguards For Information. Retrieved June 20, 2019, from https://www.blue-pencil.ca/archive-storage-options-andsafeguardsfor-information/

[23] Rouse, M. (November 2017). Data Management. Retrieved June 23, 2019, from https://searchdatamanagement.techtarget.com/de finition/data-management

[24] Rouse, M. (2017). Data Archiving. Retrieved June 20, 2019, from https://searchdatabackup.techtarget.com/definitio n/data-archiving

[25] Spiro, L. (January 2009). Archival Management Software: A Report for the Council on Library and Information Resources. Council on Library and Information Resources Washington, D.C. Retrieved July 24, 2019, from https://www.clir.org/wp-content/uploads/sites/6/spiro_Jan13.pdf

[26] Veritas.edu.ng (2018). History: Veritas University, Abuja (VUNA), the Catholic University of Nigeria. Retrieved July 22, 2019, from https://www.veritas.edu.ng/about/history.php

[27] Mkpojiogu, E.O.C. & Hashim, N.L. (2017). Assessing the efficiency of scoring rubrics assisted reading approach in the review of software requirements work products. *Journal of Engineering and Applied Sciences (JEAS),* 12(8 SI), 8355-8359.

[28] vom Brocke, J., Simons, A., Riemer K., Niehaves B., Plattfaut R., & Cleven A. (2015). Standing on the Shoulders of Giants: Challenges and Recommendations of Literature Search in Information Systems Research. Communications of the Association for Information Systems, 37, pp. 211. https://doi.org/10.17705/1CAIS.03709

[29] Yadav, D. (2016). Opportunities and Challenges in Creating Digital Archive and Preservation: An Overview. International Journal of Digital Library Services (IJODLS) 6 (2) ISSN:2250-1142. Retrieved from http://www.ijodls.in/uploads/3/6/0/3/3603729/ijo dls727.pdf

[30]   Zhang, R., Zhang, M., & Pu, G. (2019). Web-
        based Medical Data Archive System. Retrieved
        July   2019   from
        https://pdfs.semanticscholar.org/5a48/4a4ee6594
        ba96c5a62c2b7ab28abfa207550.pdf