**DESIGN AND IMPLEMENTATION OF A USER-FRIENDLY DIGITAL LIBRARY SYSTEM FOR A DEPARTMENT (USING COMPUTER SCIENCE DEPARTMENT AS A CASE STUDY).**

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**CERTIFICATION**

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**CHAPTER ONE**

**1.0 INTRODUCTION**

Library automation started in the 1960s in the USA. Since then, the trend of library automation has been spreading all over the world. Nowadays libraries are continuously increasing in number, and most are being automated. This automation is actually a combination of hardware and software, both being necessary for any automated system. In the field of libraries, software has become more important than hardware. Hundreds of library software packages have been developed and run successfully in advanced countries and there are many directories and other tools available to help librarians in the selection of suitable software for their libraries (Morgan, 2002).

Information and communication technology (ICT) that develops dynamically provides convenience and speed of service by users. In addition to providing a great opportunity to compete for libraries to improve the quality of their services. With very rapid technological advances at this time also facilitate the dissemination of information quickly to parts of the world (Ananda 2003). The development of information technology that is getting higher In a country makes the fulfillment of the country’s information needs higher (Yusrizal 2016).Based on this, there is an awareness to utilize information technology, followed up by implementing and investing in information technology, in the form of software and hardware, as well as infrastructure, so that technology can provide utility and accommodate library programs according to their objectives. Information technology is interpreted as a technology for the procurement, storage, and dissemination of various kinds of information sources by using existing computers or telecommunications(Ardoni, 2019). Therefore, there is a great motivation to manifest new technologies that can overcome the obstacles of humans managing information (Ardoni 2019). The obstacle is felt because the capacity of information spread quickly. Information technology allows the consumption of large amounts of information and at an extraordinary time (Ardoni, 2019). This ability is due to the “spearhead" of information technology, namely computers (Ardoni, 2019). Likewise, the information technology in the library of IAIN Batusangkar is the spearhead for universities to support the *Tri Dharma* of Higher Education

The e-Library concept is one version to make it easier when doing information retrieval in the library because this process provides convenience in tracing processes in the library. E-Library is one of the perceptions proposed for technological advances that occur today (Husna, 2018). This concept is able to transmit conventional libraries to digitization from the input system to the fast and up to date Search for information sources process (Nawi and Yuhanef2007).

The web-based library management system is aimed towards designing a system that

controls the activities which enables the libraries to keep a record of their stock and

monitor the status of same as well as satisfying the vast and varying needs of the

numerous patrons. The library played an important role in the daily teaching,

scientific research and learning among teachers and students. The management of

the library information using computers will reduce manual management mistakes

and enhance the efficiency of book management greatly. The chance in

technological advancement from the age of industrial attachment to the era of

information technology has quite increased (Njoku, 2001). It is now known that

information technology comprising computers and communication capabilities is

the fastest growing technology in the world today.

If the libraries threatened by the task of organizing and managing information are

to exist today, it must meet the need of its ever-growing patrons. With web-aided or

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method.

**1.2 MOTIVATION OF THE STUDY**

With the proliferation of digital information and the internet, traditional library systems are no longer sufficient to meet the needs of students and faculty members in a department. The increasing demand for quick and easy access to materials, past questions, journals, past project materials, information about the department and its faculty, as well as information about courses to be offered, calls for the implementation of a user-friendly digital library system. Therefore, this study aims to design and implement a digital library system that is tailored to the needs of the Computer Science Department, as a case study.

The proposed digital library system will serve as a one-stop-shop for students and faculty members to access digital resources conveniently and efficiently. It will be designed with a user-centric approach, making it easy to navigate and intuitive to use. Additionally, it will provide a centralized repository for course materials, past project materials, journals, and other digital resources, which can be accessed remotely at any time.

The implementation of this digital library system will have several benefits. Firstly, it will reduce the time and effort required to search for materials manually, allowing students and faculty members to focus on their research and coursework. Secondly, it will enhance collaboration and knowledge sharing among students and faculty members, as they will have access to a centralized platform for sharing and accessing information. Lastly, it will provide an opportunity for the Computer Science Department to leverage technology to enhance its operations and better serve its stakeholders.

Overall, this study is motivated by the need to address the challenges faced by the traditional library system and to provide a more efficient and effective alternative. By designing and implementing a user-friendly digital library system, this study aims to contribute to the improvement of digital literacy and knowledge sharing in the Computer Science Department.

**1.3 STATEMENT OF PROBLEM**

The Computer Science Department at Adekunle Ajasin University faces a challenge in providing students and faculty members with easy and efficient access to digital resources such as course materials, past questions, journals, past project materials, information about the department and its faculty, as well as information about courses to be offered. The traditional library system, which requires students and faculty members to physically access the library, search through a limited collection of resources, and borrow materials, is becoming increasingly inadequate in meeting the needs of a digitally savvy community.

Therefore, the problem that this study aims to address is the lack of a user-friendly and centralized digital library system in the Computer Science Department at Adekunle Ajasin University, which can provide students and faculty members with quick and easy access to digital resources. The proposed digital library system will be designed to address these challenges and provide a centralized platform for students and faculty members to access the digital resources they need to support their research and coursework. By addressing this problem, this study aims to enhance digital literacy and knowledge sharing in the Computer Science Department.

**1.4 AIMS AND OBJECTIVES OF THE STUDY**

**1.4.1 AIM**

The aim of this study is to design and implement a user-friendly digital library system for the Computer Science Department. The system will provide quick and easy access to digital resources, tailored to the specific needs of the department. The study aims to improve digital literacy and knowledge sharing, and enhance the learning experience of students and teaching activities of faculty members.

**1.4.2 OBJECTIVES**

The following objectives will be achieved:

1. To identify the digital resource (digital resources can include a wide range of materials such as e-books, digital textbooks, journal articles, conference proceedings, multimedia content, past exams and questions, lecture notes, and other online educational resources.) needs of the Computer Science Department of Adekunle Ajasin University.
2. To design a user-friendly digital library system that meets the identified digital resource needs of the department.
3. To implement the digital library system and integrate it into the existing infrastructure of the department.
4. To test and evaluate the usability and effectiveness of the digital library system through user feedback and metrics.
5. To provide recommendations for future improvements and enhancements to the digital library system based on the evaluation results.

**1.5 METHODOLOGY**

The proposed methodology of the digital E-Library system is listed below:

1. **Literature Review**: Conduct a thorough review of existing literature on digital library systems, user experience design, and best practices in the design and implementation of digital library systems.
2. **Needs Assessment**: Conduct a needs assessment by surveying students, faculty members, and staff in the Computer Science Department to identify their specific digital resource needs, requirements, and preferences.
3. **System Design**: Design the digital library system, including the user interface, database structure, and system architecture, based on the needs assessment findings and literature review.
4. **System Implementation**: Implement the digital library system using appropriate software development tools and technologies.
5. **System Testing and Evaluation**: Test and evaluate the usability and effectiveness of the digital library system through user feedback and metrics such as user satisfaction surveys, system usage statistics, and system performance data.
6. **Recommendations for Improvement**: Based on the evaluation results, provide recommendations for future improvements and enhancements to the digital library system.

**1.6 SIGNIFICANCE OF THE STUDY**

The significance of this study lies in its potential to improve the quality of teaching, learning, and research in the Computer Science Department at Adekunle Ajasin University. By designing and implementing a user-friendly digital library system that provides quick and easy access to digital resources, tailored to the specific needs of the department, students and faculty members will have access to a wide range of educational resources that can support their academic and professional development.

**1.7 SCOPE OF THE STUDY**

The study will focus on identifying the digital resource needs and preferences of students, faculty members, and staff in the department, and designing a digital library system that meets these needs. The study will also evaluate the usability and effectiveness of the digital library system through user feedback and metrics such as user satisfaction surveys, system usage statistics, and system performance data.

The study will not involve the creation or development of new digital resources, but will focus on the design and implementation of a digital library system that provides easy access to existing digital resources. The study will also be limited to the Computer Science Department at Adekunle Ajasin University and will not cover other departments or disciplines.

**CHAPTER TWO**

**LITERATURE REVIEW**

**2.1 INTRODUCTION**

This section provides an overview of the concept of digital libraries, their importance in the academic environment, and the challenges they pose to users and librarians. Digital libraries are online collections of digital resources that are accessible through the internet. They contain a wide range of materials, including books, journals, articles, theses, dissertations, and multimedia resources, among others. The use of digital libraries has grown significantly over the years due to the widespread availability of internet access and the convenience they offer in terms of accessing information.

**2.1.1 IMPORTANCE OF DIGITAL LIBRARIES**

Digital libraries play an important role in supporting academic research and teaching. They provide access to a vast array of resources that are not available in traditional libraries, which makes it easier for students and researchers to find the materials they need. Digital libraries also offer new ways of searching and browsing information, allowing users to search across multiple databases simultaneously and retrieve relevant results quickly.

In addition, digital libraries can be accessed from anywhere at any time, making them particularly useful for students who need to access materials outside of regular library hours. They also offer cost savings for academic institutions by reducing the need for physical space and the costs associated with acquiring and maintaining print materials.

**2.1.2 CHALLENGES OF DIGITAL LIBRARIES**

Despite their many benefits, digital libraries also present challenges to users and librarians. One of the biggest challenges is the sheer volume of information available in digital libraries, which can be overwhelming for users. In addition, the quality and reliability of information in digital libraries can be difficult to assess, particularly when dealing with user-generated content.

Another challenge is ensuring that digital libraries are accessible and user-friendly for all users, including those with disabilities. This requires careful attention to user interface design and information architecture.

**2.1.3 BEST PRACTICES IN DIGITAL LIBRARY SYSTEM DESIGN**

Designing a user-friendly digital library system requires careful consideration of user needs and behaviors, as well as attention to best practices in user experience design and information architecture. The following literature review will examine some of the key issues and approaches to designing effective digital library systems.

**2.1.3.1 USER EXPERIENCE DESIGN**

User experience (UX) design is the process of designing digital products or systems that are easy to use, efficient, and enjoyable for users. In the context of digital libraries, UX design involves understanding how users interact with information and designing interfaces that are intuitive and easy to use. Best practices in UX design for digital libraries include:

* Conducting user research to understand user needs and behaviors
* Using clear and consistent navigation and labeling
* Providing meaningful search results and filters
* Displaying relevant metadata and context information
* Using visual design to enhance usability and engagement

(Krug, 2014; Rosenfeld & Morville, 2015; Shen, 2015)

**2.1.3.2 INFORMATION ARCHITECTURE**

Information architecture (IA) is the process of organizing and structuring information to support effective information retrieval and use. In the context of digital libraries, IA involves creating a clear and consistent structure for organizing and accessing information. Best practices in IA for digital libraries include:

* Creating a clear and consistent structure for organizing materials
* Using controlled vocabularies and metadata to facilitate searching and browsing
* Providing multiple pathways for accessing information
* Ensuring that the system is scalable and adaptable to changing needs

(Morville & Rosenfeld, 2007; Resmini & Rosati, 2011)

By incorporating best practices in UX design and IA, digital library systems can be designed to meet the needs of users and support effective information retrieval and use.

**2.2 REVIEW OF RELATED WORKS**

Several studies have been conducted on the design and implementation of digital library systems. This section provides a review of some of the most relevant studies.

**2.2.1 DESIGN AND IMPLEMENTATION OF DIGITAL LIBRARY SYSTEMS**

Majid and Abrizah (2014) designed and implemented a digital library system for a Malaysian university. The system was designed to provide easy access to electronic resources and promote collaboration among faculty and students. The system was built using open source software, and was found to be effective in improving access to electronic resources.

Similarly, Daramola and Akande (2018) designed and implemented a digital library system for a Nigerian university. The system was designed to provide easy access to electronic resources, as well as promote information literacy among students. The system was found to be effective in improving access to electronic resources and promoting information literacy.

**2.2.2 USER INTERFACE DESIGN IN DIGITAL LIBRARY SYSTEMS**

User interface design is a critical factor in the usability and effectiveness of digital library systems. A number of studies have explored various aspects of user interface design in digital library systems.

For example, Choi et al. (2013) investigated the effects of interface design on the usability of digital library systems. The study found that interface design factors such as layout, navigation, and search functionality can significantly impact the usability of digital library systems.

**2.2.3 DIGITAL LIBRARY SYSTEMS IN INSTITUTIONS AND DEPARTMENTS**

In the context of academic institutions and departments, digital library systems have been designed to cater to the specific needs of students, faculty, and staff. Several studies have investigated the effectiveness of these systems in meeting the information needs of users.

A study by Karisiddappa et al. (2013) examined the effectiveness of digital library systems in meeting the information needs of students in engineering colleges. The study found that digital library systems were effective in providing access to a wide range of resources, including e-books, e-journals, and digital archives. However, the study also highlighted the need for improved search functionality and user interface design to enhance the user experience.

Another study by Sharma and Kumar (2014) investigated the usage patterns and user satisfaction of digital library systems in Indian universities. The study found that while digital library systems were widely used by students and faculty, there were several challenges, including limited access to resources, inadequate user training, and poor user interface design.

In addition to these studies, several digital library systems have been developed specifically for academic institutions and departments. For example, the EPrints digital repository system has been widely adopted by academic institutions to manage and share research outputs (Dobreva et al., 2010). Another example is the D-Space digital library system, which has been used by academic institutions to manage and share scholarly materials (Bhattacharyya et al., 2008). These systems have been designed to meet the specific needs of academic users, including support for open access publishing, institutional repositories, and digital archives.

**Figure 2.1 LITERATURE REVIEW TABLE.**

| S/N | Study Title | Authors | Year | Research Focus | Key Findings |
| --- | --- | --- | --- | --- | --- |
| 1 | "Design and Implementation of a Digital Library System for Academic Libraries in Nigeria" | Adigun, A. A., Oluwagbemi, O. O., & Oke, O. A. | 2019 | Design and implementation of a digital library system in academic libraries in Nigeria | Identified the importance of digital library systems for academic libraries in Nigeria and provided a design framework for building a user-friendly digital library system. |
| 2 | "Assessment of Students' Perception on the Use of Digital Library in Nigerian Universities" | Ugwu, C. I., & Akpa, G. O. | 2018 | Assessment of students' perception and use of digital libraries in Nigerian universities | Revealed that students have positive attitudes towards using digital libraries and found the digital library systems to be beneficial in supporting their academic work. Identified challenges such as inadequate infrastructure and limited access to relevant resources. |
| 3 | "Design and Implementation of an E-Library System for Undergraduate Students of Osun State University" | Adebowale, O. A., Adebowale, O. B., & Olaniyi, E. O. | 2017 | Design and implementation of an e-library system for undergraduate students of Osun State University in Nigeria | Developed an e-library system that included features such as search, retrieval, and sharing of digital resources. Identified the need for user-friendly interfaces and regular updates to the system. |
| 4 | "Development and Implementation of Digital Library System in the Universities: A Case Study of Pakistan" | Hussain, A., Ahmad, N., & Khan, M. A. | 2017 | Development and implementation of digital library systems in Pakistani universities | Identified the importance of digital library systems in supporting teaching, learning, and research activities. Found that lack of digital literacy skills among users and limited access to relevant digital resources were major challenges in implementing digital library systems. |

**2.3 DIGITAL LIBRARY SYSTEM ARCHITECTURE**

Digital library systems are complex software systems that require a well-defined architecture to function effectively. Several studies have proposed various architectures for digital library systems.

One proposed architecture for digital library systems is the Service-Oriented Architecture (SOA) (Zhang et al., 2012). The SOA architecture consists of several loosely coupled services that work together to provide access to digital resources. This architecture allows for flexibility and scalability, making it well-suited for large-scale digital library systems.

Another proposed architecture for digital library systems is the Modular Digital Library Architecture (MDLA) (Liu et al., 2009). The MDLA architecture consists of several modules that work together to provide access to digital resources. Each module is responsible for a specific functionality, such as metadata management, content management, and user management.

**2.4 TECHNOLOGIES USED IN DIGITAL LIBRARY SYSTEMS**

Digital library systems rely on several technologies to function effectively. These technologies include software frameworks, programming languages, and database management systems.

One widely used software framework for digital library systems is the Django framework (Hirabayashi et al., 2013). The Django framework is a web framework that is well-suited for developing digital library systems. It provides support for database management, user authentication, and content management.

Another technology used in digital library systems is the MySQL database management system (He, 2010). MySQL is a widely used open-source database management system that is well-suited for managing large volumes of data, making it an ideal choice for digital library systems.

Other technologies used in digital library systems include programming languages such as Java and Python, web development tools such as HTML and CSS, and metadata standards such as Dublin Core and MARC. The choice of technologies used in a digital library system depends on the specific requirements of the system and the expertise of the development team.

**2.5 SUMMARY**

This chapter has provided an overview of the digital library system and the related works in this field. The literature review has shown that digital library systems have become increasingly important in educational institutions and that they provide several benefits, including easy access to educational resources and enhanced learning outcomes.

The literature review has also shown that several digital library systems have been developed for educational institutions, and that these systems have employed various technologies and architectures to provide access to digital resources. The Service-Oriented Architecture (SOA) and the Modular Digital Library Architecture (MDLA) are two proposed architectures for digital library systems, while the Django framework and the MySQL database management system are among the technologies used in digital library systems.

The next chapter will describe the methodology that will be used to design and implement the digital library system for the Computer Science Department at Adekunle Ajasin University.

**CHAPTER THREE**

**METHODOLOGY**

**3.1 SYSTEM ANALYSIS AND DESIGN**

The System Analysis and Design phase is a critical stage in the software development process that involves understanding the current system or process, identifying problems and areas for improvement, and designing a new system that meets the identified needs. It is a structured approach to analyzing and designing a software solution that meets the requirements of the end-users.

In the context of this project, the System Analysis and Design phase involves analyzing the current manual process of accessing and managing books in the library, identifying the problems associated with it, and designing a new system that will address these problems.

The architectural model which will be later discussed will be used as a basis for designing the new system. This model will guide the process of identifying the system components, their relationships, and the interactions between them. It will also provide a framework for selecting appropriate hardware, software, and communication technologies for the new system.

The System Analysis and Design phase will also involve the creation of use cases, which are a way of capturing the functional requirements of the system. Use cases describe the interactions between the user and the system, the actions performed by the system, and the responses given by the system. The use cases will be used to identify the system requirements and to design the user interface.

Another important aspect of the System Analysis and Design phase is the creation of data models, which are used to represent the data entities and their relationships in the system. This involves identifying the data entities, their attributes, and the relationships between them. The data model will guide the design of the database schema and the creation of the database tables.

In summary, the System Analysis and Design phase is a critical stage in the software development process that involves analyzing the current system, identifying problems and areas for improvement, and designing a new system that meets the identified needs. In the System Analysis and Design section, the focus is on analyzing the requirements of the system, designing the system architecture, and creating the user interface.

**3.1.1 REQUIREMENT GATHERING**

This stage involves collecting information from stakeholders and end-users to understand their needs and requirements for the digital library system. It involves conducting surveys, interviews, and research to gather and analyze information about the system's functional and non-functional requirements.

**3.1.2 SYSTEM DESIGN**

This stage involves the creation of the system's architecture, defining the components and their interactions, and mapping out the system's behavior. It involves creating a detailed system design document that outlines the system's functionalities and specifications, including the hardware and software requirements, system interfaces, and integration points.

**3.1.2.1 ARCHITECTURAL MODEL**

The digital library system will be designed using a four-tier architecture, which separates the presentation layer, application layer, and database layer.

**The presentation layer** will be responsible for presenting the user interface to the user and will be implemented using HTML, CSS, and Bootstrap.

**The client-side scripting layer** will be responsible for implementing the dynamic behavior of the system on the client-side using JavaScript.

**The application layer** will be responsible for implementing the core functionality of the system, such as managing user accounts, digital resources, courses, and the student executive. This layer will be implemented using PHP, a server-side scripting language.

**The database layer** will be responsible for managing the system's data and will be implemented using MySQL, a popular open-source relational database management system. By separating the application layer from the database layer, the system can be more easily scaled and maintained, and security can be improved by implementing appropriate access controls and encryption mechanisms.

In addition, the system will be hosted on a website to improve its availability and provide easy access to users. By utilizing a web-based approach, the system can be accessed from any device with an internet connection, which will increase its accessibility to users.

To further enhance the user experience, the system will be designed with a responsive layout that adapts to different screen sizes and resolutions, ensuring that users can access and use the system regardless of the device they are using.

Overall, the proposed architectural model provides a scalable, maintainable, and secure digital library system that is easily accessible to users, improving the overall user experience.

**3.1.3 DATABASE DESIGN**

This stage involves the design of the database schema, defining the data structures, relationships, and constraints that the system requires to function. It involves identifying the data requirements, creating an ER diagram, normalizing the data, and defining data access rules.

**3.1.4 INTERFACE DESIGN**

This stage involves the creation of the user interface, which is the primary means of interaction between the user and the system. It involves designing a user-friendly interface that is easy to use, intuitive, and accessible. It includes creating wireframes, designing user flows, and defining the system's visual and interaction design elements.

Together, these four components form the backbone of the system analysis and design phase, which is crucial in ensuring the successful development and implementation of the digital library system. The architectural model, as discussed earlier, plays a critical role in each of these stages, providing a blueprint for the system's development and integration.

**CHAPTER 3.2 DEVELOPMENT PROCESS**

The development process for the digital library system began with the identification of project requirements and the selection of suitable programming languages and tools. Various programming languages and tools were evaluated to ensure a robust and efficient system.

The system prototype was designed and developed for functionality testing and identification of areas for improvement before the final development stage. The final system was thoroughly tested to ensure that it met the project requirements and was fully functional.

The database design was created to ensure efficient management and storage of large amounts of data, while the interface design was given priority to ensure user-friendly navigation and quick access to the required information.

In summary, the development process of the digital library system covered the selection of programming languages and tools, prototyping, system testing, database design, and interface design.

**CHAPTER 3.3 IMPLEMENTATION**

The implementation of the digital library system is done using the programming languages and tools selected for the project. The system is developed using the three-layered architecture, consisting of the presentation layer, business logic layer, and data storage layer.

The presentation layer is developed using HTML, CSS, and Bootstrap. The user interface is designed to be user-friendly and intuitive. The business logic layer is developed using PHP, which handles the processing of user requests and interacts with the data storage layer. The data storage layer is developed using MySQL, which handles the storage and retrieval of data.

The front-end development phase involves the development of the user interface using HTML, CSS, and Bootstrap. The user interface is designed to be responsive and compatible with different devices.

The back-end development phase involves the development of the business logic using PHP. The PHP scripts handle the processing of user requests and interact with the data storage layer.

The database development phase involves the development of the data storage layer using MySQL. The database schema is designed to store the required data, including user information, book information, and transaction information.

The testing phase involves different levels of testing to ensure that the system meets the requirements and works as expected. Unit testing is done to test individual components, integration testing is done to test the interaction between different components, and system testing is done to test the system as a whole.

The system is deployed on a web server, and maintenance activities such as bug fixing, updates, and upgrades are performed to ensure that the system continues to meet the requirements and works as expected.

Overall, the methodology and implementation adopted in this project ensure that the digital library system is developed according to the requirements and works as expected. The use of the Waterfall Model ensures that the project follows a structured approach, and the three-layered architecture ensures that the system is modular, scalable, and maintainable

**CHAPTER 3.4 MAINTENANCE AND SYSTEM TESTING**

System maintenance is an important phase in the system development life cycle, which involves ongoing activities that ensure the system remains operational and meets the needs of its users. The main activities in this phase include system backup and recovery, system updates and upgrades, system security and data protection, and system performance monitoring and optimization.

System backup and recovery involve creating and storing backups of the system data to ensure that data can be recovered in the event of a system failure or data loss. This ensures that the system is always available to its users and that data is not lost due to hardware or software failure.

System updates and upgrades involve making changes to the system to improve its performance, fix bugs, and enhance its functionality. This involves identifying areas that need improvement, testing and implementing updates, and ensuring that the system continues to operate smoothly after the updates.

System security and data protection involve implementing measures to protect the system and its data from unauthorized access, theft, and damage. This includes implementing firewalls, antivirus software, and encryption, as well as training users on security best practices and ensuring that access to the system and its data is restricted to authorized users only.

System performance monitoring and optimization involve monitoring the system's performance to identify areas that need improvement, such as slow response times or system crashes, and implementing measures to optimize the system's performance. This includes identifying and addressing hardware or software issues, as well as monitoring system resources and usage patterns to ensure that the system can handle peak loads without slowing down or crashing.

In summary, the system maintenance phase is critical to ensuring the ongoing operation and usability of the system, and it involves a range of activities to ensure that the system remains secure, up-to-date, and performing optimally.

**CHAPTER FOUR**

**METHODOLOGY**

**3.1 SYSTEM ANALYSIS AND DESIGN**

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Lanagan, James; Smeaton, Alan F. (September 2012). "Video digital libraries: contributive and decentralized". International Journal on Digital Libraries. **12** (4): 159–178. [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.1007/s00799-012-0078-z](https://doi.org/10.1007%2Fs00799-012-0078-z). [S2CID](https://en.wikipedia.org/wiki/S2CID_(identifier)) [14811914](https://api.semanticscholar.org/CorpusID:14811914).

Lynch, Clifford (2005). ["Where Do We Go From Here? The Next Decade for Digital Libraries"](https://doi.org/10.1045%2Fjuly2005-lynch). D-Lib Magazine. **11** (7/8). [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.1045/july2005-lynch](https://doi.org/10.1045%2Fjuly2005-lynch). [ISSN](https://en.wikipedia.org/wiki/ISSN_(identifier)) [1082-9873](https://www.worldcat.org/issn/1082-9873). This is a field with an incredibly rich, and, as yet, poorly chronicled pre-history and early history. There is a stream of work and ideas that reaches back to at least the turn of the 20th century, and includes such thinkers as H.G. Wells and Paul Otlet; later contributors to the pre-history of visions of new, technologically-enabled means of knowledge organization, access and distribution also include Vannevar Bush and J.C.R. Licklider.

Schatz, Bruce (1997). ["Information Retrieval in Digital Libraries: Bringing Search to the Net"](https://doi.org/10.1126%2Fscience.275.5298.327). Science. **275** (5298): 327–334. [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.1126/science.275.5298.327](https://doi.org/10.1126%2Fscience.275.5298.327). [PMID](https://en.wikipedia.org/wiki/PMID_(identifier)) [8994022](https://pubmed.ncbi.nlm.nih.gov/8994022).

Stocker, Gerfried (1 January 2014). ["Beyond Archives (or the Internet 100 years before the Internet)"](https://books.google.com/books?id=b3aCCwAAQBAJ). In Magalhães, Ana Gonçalves; Beiguelman, Giselle (eds.). Possible Futures: Art, Museums and Digital Archives. [ISBN](https://en.wikipedia.org/wiki/ISBN_(identifier)) [9788575963548](https://en.wikipedia.org/wiki/Special:BookSources/9788575963548). Retrieved 30 April 2018. Actually it was 1895 when Paul Otlet together with Henry La Fontaine, who was later awarded the Nobel Peace Prize, started a project – Mundaneum – that was initiated and driven by their idea that, if they would be able to collect all human knowledge and make it accessible to everybody worldwide, then this would bring about peace on Earth.

Wiederhold, Gio (1993). "Intelligent integration of information". ACM SIGMOD Record. **22** (2): 434–437. [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.1145/170036.170118](https://doi.org/10.1145%2F170036.170118).

  Witten, Ian H.; Bainbridge, David Nichols (2009). How to Build a Digital Library (2nd ed.). Morgan Kaufman. [ISBN](https://en.wikipedia.org/wiki/ISBN_(identifier)) [9780080890395](https://en.wikipedia.org/wiki/Special:BookSources/9780080890395).