

RESEARCH TRACKING SYSTEM

By

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H200210R

HIT400 Capstone project Submitted in Partial Fulfillment of the

Requirements of the degree of

Bachelor of Technology

In

Software Engineering

In the

School of Information Sciences and Technology

Harare Institute of Technology

Zimbabwe



Supervisor

.....

Month/Year

ACKNOWLEDGEMENT

First and foremost, I would like to express my gratitude to Mrs. Chibaya, my project supervisor, for her invaluable guidance and unwavering supervision, which played a crucial role in the completion of this project. I extend my heartfelt thanks to my brothers for their unwavering support, which enabled me to pursue my degree in Software Engineering. Above all, I am profoundly grateful to the Almighty for granting me the strength and for blessing my endeavors with success.

ABSTRACT

The current method of managing research information at our university is heavily reliant on physical hard files and paper-based documentation, leading to inefficiencies and challenges in organization, accessibility, security, and sustainability. This project aims to transition from a manual and paper-driven system to an automated digital solution for storing, retrieving, and managing research data conducted by students and faculty. The proposed digital platform will centralize research information, making it easily accessible and secure, while significantly reducing the environmental impact associated with paper use. By leveraging advanced technologies, this project will enhance data management efficiency, ensure robust data security through encryption and access controls, and promote sustainability. The implementation of this digital system is expected to streamline research operations, safeguard valuable research data, and support the university's commitment to eco-friendly practices.

PREFACE

Table of Contents

Acknowledgements.....	I
Abstract.....	II
Chapter 1:Proposal.....	1
1.1Background.....	1
1.2Problem Statement.....	1
1.3 Objectives.....	1
1.4 Hypothesis	1
1.5Justification.....	2
1.5.1 Rationale.....	2
1.6 Proposed Tools.....	2
1.7Feasibility study:Technical,Economic&Operational.....	2
1.7.1 Technical Feasibility.....	2
1.7.2 Economic Feasibility.....	3
1.7.3 Operational Feasibility.....	3
1.8 Project plan –Time plan, Gantt chart.....	3
1.8.1 Budget Estimate	4
1.8.2 Time plan, Gantt chart.....	4
Chapter 2: Literature Review.....	5
2.1 Introduction	5
2.2 Related work.....	5
2.2.1 Efficient Document Clustering and Indexing for Information Retrieval	5
2.2.2 A Survey of NoSQL Databases for Document Storage :	5
2.2.3 Advanced Techniques for Document Categorization in Research Management Systems.....	6
2.2.4 Scalable and Efficient Search Algorithms for Large-Scale Document Repositories	6
2.2.5 Semantic Indexing for Enhanced Retrieval of Research Documents	6
2.3 Conclusion.....	6
Chapter 3: Requirements Analysis.....	7
3.1 Information GatheringTools	7
3.2 Description of system.....	7

3.3 Current system.....	8
3.4 Evaluation Of Alternative Systems.....	9-10
3.5 Fuctional analysis of proposed system-fuctional and Non-functional requirements.....	11
3.5.1 Functional Requirements.....	11-12
3.5.2 Non-Functional Requirements.....	12
3.6 Use Case Diagrams.....	14
Chapter 4: Design	15
4.1 Introduction	15
4.2 Systems Diagrams.....	15-16
4.3 Architectural Design.....	17
4.4 Program Design.....	17-18
4.5 Pseudo code of major modules	19-20
4.5.1 Document Indexing and Categorization:.....	19
4.5.2 Search Algorithm.....	19
4.5.3 User Interface Design.....	20
4.6 Interface Design-Screenshots of user interface.....	21-24
Chapter 5: Systems Testing	25
5.1 Introduction	25
5.2 Sample code.....	34
5.2.1 registration module.....	25-26
5.2.2 code of the web application.....	27-29
5.2.3 search module.....	30-35
5.3 Software Testing.....	35
5.3.1 Unit testing.....	35
5.3.2 Module testing.....	37
5.3.3 Integration testing.....	37
5.3.4 System testing.....	38
5.3.4.1 Black Box	38
5.4 Conclusion	40
Chapter 6: Conclusion.....	42
6.1 Conclusion	42
6.2 Recommendations.....	43
6.3 Future Works.....	43-44

References.....	44
Appendix 1:Templates of data collection tools.....	45-46
Appendix 2: User Manual	47-50
Appendix 3 : Sample Code.....	51-53
Appendix4 : research papers.....	54
Appendix 5:Technical Paper.....	55-61
Appendix6:Survey Paper.....	62-64

List of tables

Table 1: Unit Testing results.....	35
Table 2:Integration Testing results.....	37
Table 3:Black Box Testing results.....	38
Table 4: Functional Testing results	39
Table 5:Non Functional Test results.....	40
Table 6:System Test results.....	40

Table of figures

Figure 1: Time plan Gantt Chart.....	4
Figure 2:Conext Level Diagram for current system.....	8
Figure 3:Use Case for the current system.....	14
Figure 4:Use case diagram for the proposed solution.....	14
Figure 5: Context Level Diagram for proposed sysytem	15
Figure 6:Activity Diagram.....	16
Figure 7:Process Flow Diagram	16
Figure 8:Architectural Design.....	17
Figure 9:Class Diagram.....	17
Figure 10: Sequence Diagram.....	18
Figure 11:Package Diagрма.....	18

Figure 12: Login Page.....	21
Figure 13: Registration Page	21
Figure 14: Searching Page.....	22
Figure 15: Results Page.....	22
Figure 16: Upload Page.....	23
Figure 17: Total projects in system.....	23
Figure 18: Project Information Page	24



This is to certify that HIT 400 Project entitled “Research tracking system” **has** been completed by Michael Mazenge H200210R for partial fulfilment of the requirements for the award of **Bachelor of Technology** degree in **Software Engineering**. This work is carried out by him under my supervision and has not been submitted earlier for the award of any other degree or diploma in any university to the best of my knowledge.

Mrs Chibaya

Approved/Not Approved

Project Supervisor

Project Coordinator

Signature:

Signature:

Date:

Date:



Certificate of Declaration

This is to certify that work entitled “HIT400 Research Tracking System “is *submitted in partial fulfillment of the requirements for the award of Bachelor of Technology (Hons) in Software Engineering, Harare Institute of Technology. It is further certified that no part of research has been submitted to any university for the award of any other degree.*

(mrs chibaya)

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(Mr Makondo)

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Date.....

Project Documentation Marking Guide

ITEM	TOTAL MARK /%	ACQUIRED/%
PRESENTATION- Format-Times Roman 12 for ordinary text, Main headings Times Roman 14, spacing 1.5. Chapters and sub-chapters, tables and diagrams should be numbered. Document should be in report form. Range of document pages. Between 50 and 100. Work should be clear and neat	5	
Pre-Chapter Section Abstract, Preface, Acknowledgements, Dedication & Declaration	5	
Chapter One-Introduction Background, Problem Statement, Objectives – smart, clearly measurable from your system. Always start with a TO... Hypothesis, Justification, Proposed Tools Feasibility study: Technical, Economic & Operational Project plan –Time plan, Gantt chart	10	
Chapter Two-Literature Review Introduction, Related work & Conclusion	10	
Chapter Three –Analysis Information Gathering Tools, Description of system Data analysis –Using UML context diagrams, DFD of existing system Evaluation of Alternatives Systems, Functional Analysis of Proposed System-Functional and Non-functional Requirements, User Case Diagrams	15	
Chapter Four –Design Systems Diagrams –Using UML Context diagrams, DFD, Activity diagrams Architectural Design-hardware, networking Database Design –ER diagrams, Normalized Databases Program Design-Class diagrams, Sequence diagrams, Package diagrams, Pseudo code Interface Design-Screenshots of user interface	20	
Chapter Five-Implementation & Testing Pseudo code of major modules /Sample of real code can be written here Software Testing-Unit, Module, Integration, System, Database & Acceptance	20	
Chapter Six –Conclusions and Recommendations Results and summary, Recommendations & Future Works	10	
Bibliography –Proper numbering should be used Appendices –templates of data collection tools, user manual of the working system, sample code, research papers	5	
	100	/100

CHAPTER 1 Proposal

1.1 Background

In today's digital age, the academic environment at our university is hindered by an outdated and inefficient system for managing research information. The current reliance on physical hard files and paper-based documentation has created a bottleneck in accessing and managing research data conducted by both students and faculty. This manual system is not only time-consuming but also poses significant challenges in terms of organization, accessibility, security, and sustainability.

Physical files are often stored in various locations across the campus, making it difficult for researchers to quickly locate and retrieve the information they need. The decentralized nature of this storage system results in a lack of standardization, leading to potential inconsistencies and errors in data management. Moreover, physical documents are susceptible to damage, loss, and unauthorized access, raising concerns about the security and integrity of valuable research data.

The environmental impact of maintaining a paper-based system cannot be overlooked either. The continual use of paper contributes to deforestation and increases the university's carbon footprint, counteracting efforts to promote sustainability on campus. Furthermore, the administrative burden of managing vast amounts of physical paperwork detracts from the time and resources that could be better spent on advancing academic research and innovation.

Recognizing these challenges, there is an urgent need to transition from a manual, paper-driven system to an automated digital solution. By implementing a comprehensive digital platform for research data management, the university can significantly enhance the efficiency of data storage, retrieval, and management processes. Such a system would ensure that research information is organized in a centralized, accessible, and secure manner.

1.2 Problem Statement

In the academic environment of our university, accessing and managing research information conducted by students and faculty has been a time-consuming and cumbersome process due to the reliance on physical hard files and paper-based documentation. These hard files, often stored in various locations, pose significant challenges in terms of organization, accessibility, security, and sustainability. To address this issue, there is a pressing need to transition from a manual and paper-driven system to an automated digital solution that streamlines the storage, retrieval, and management of research data, thereby enhancing efficiency, data security, and accessibility.

1.3 Objectives

- To develop a robust document indexing and search functionality that enables the system to automatically index and categorize research documents upon upload to a NoSQL database system.
- To develop a search algorithm that efficiently retrieves relevant documents and ranks them based on relevance to the user's query.
- To design a web-based user interface to provide an intuitive and userfriendly experience of the system.

1.4 Hypothesis Statement

The development of a research tracking system with advanced document indexing and search functionality will significantly improve the efficiency of research document management and retrieval, enhancing the productivity and collaboration of research institutions and organizations.

1.5 Justification

One of the primary challenges facing researchers is the overwhelming volume of information available. With thousands of research papers published daily across various disciplines, researchers often find it challenging to sift through this vast amount of literature to find relevant information. A research tracking system with robust document indexing and search functionality can streamline this process by automatically categorizing and indexing documents upon upload, allowing researchers to quickly locate relevant literature based on their queries.

1.5.1 Rationale

Research institutions and organizations generate vast amounts of valuable research documents. However, traditional document management systems often fall short in providing efficient indexing, categorization, and retrieval capabilities. This project aims to address these shortcomings by developing a robust research tracking system. The key justifications for this project are:

Enhanced Document Organization: The system will automate the indexing, categorization, and tagging of research documents, making it easier for users to find relevant information quickly.

Time Savings: Researchers and scholars spend a significant amount of time searching for research materials. A more efficient search and retrieval system will save valuable time.

Improved Collaboration: By streamlining document access and search, collaboration among researchers and institutions will improve, fostering a more conducive research environment.

Competitive Advantage: Organizations with efficient research tracking systems can stay at the forefront of their fields by leveraging existing research and knowledge more effectively.

1.6 Proposed Tools

Technology Stack

The following tools and technologies are proposed for the development of the research tracking system:

Programming Languages: JavaScript for backend development, JavaScript for frontend.

Database: MongoDB for data storage.

Web Framework: react for front end and node for back-end .

Search Engine: Elastic search for efficient document search.

User Interface: React.js for creating a responsive and user-friendly interface.

1.7 Feasibility Study

1.7.1 Technical Feasibility

Technology Stack Assessment: The proposed tools have been evaluated for compatibility and feasibility.

Scalability: The system architecture is designed to handle a large volume of research documents efficiently.

Data Security: Measures are in place to protect sensitive research data.

1.7.2 Economic Feasibility

Cost Analysis: An initial cost estimation has been performed, and potential revenue streams have been identified.

Return on Investment (ROI): The project's ROI is projected based on user adoption and subscription models.

Risk Assessment: Identified risks and mitigation strategies have been documented.

1.7.3 Operational Feasibility

User Adoption and Training: Plans for user training and feedback collection have been outlined.

Content Management: Procedures for document uploading, categorization, and metadata extraction have been defined.

System Maintenance: Resources required for ongoing maintenance are estimated.

1.8 Timeline and budget

project initiation(month 1-2)

- defining project objectives and scope.
- Identifying key stakeholders.
- Developing the project plan including timelines ,milestones and scheduling preferences

Design and Architecture(month 3-4)

- Develop the system architecture.
- Design the user interface.
- Plan database structure.

Development(month4-7)

- implement the system architecture.
- design the user interface.
- Plan database structure.

Testing and quality assurance(month 8-9)

- Perform unit testing, integration testing, and user acceptance testing.
- Identify and address bugs and issues.
- Ensure system reliability and performance.

Proto-type production roll out(month 9-10)

- Launch the proto-type .
- monitor system performance

1.8.1 Budget Estimate

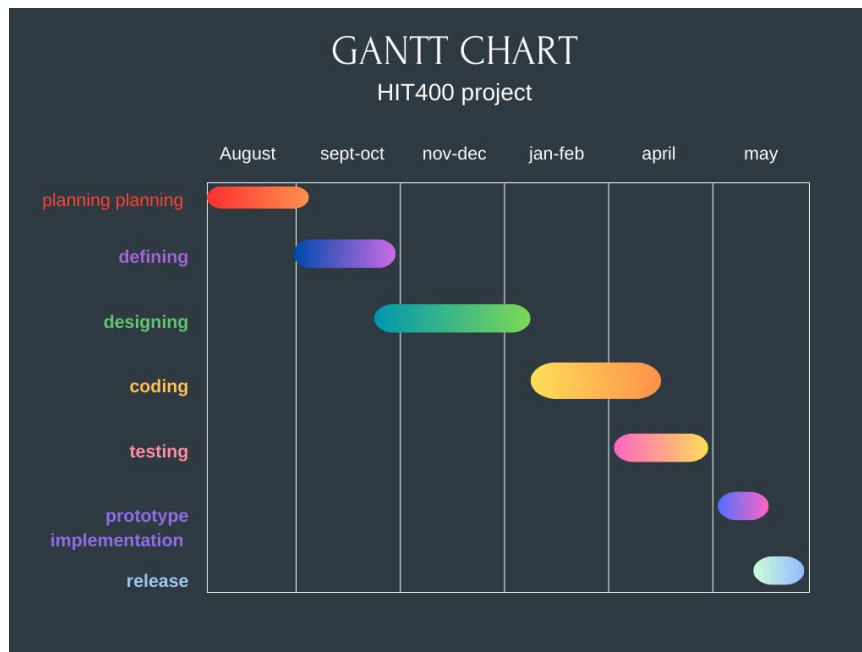
The estimated budget for the **RESEARCH TRACKING SYSTEM** project is as follows:

Development cost : \$50

Includes software licenses and development tools.

1.8.2 Time plan, Gantt chart

figure 1 :Gantt chart



CHAPTER 2

LITERATURE REVIEW

Chapter 2: Literature Review

2.1 Introduction

Research tracking systems play a crucial role in managing and accessing vast amounts of research documents efficiently. A key component of such systems is robust document indexing and search functionality, which enables automatic categorization and retrieval of documents based on user queries. In this literature review, we explore existing research focusing on document indexing, categorization, and search algorithms, with an emphasis on systems utilizing NoSQL databases for storage and retrieval.

2.2 Related Work

2.2.1 Efficient Document Clustering and Indexing for Information Retrieval

Proposed Smith and Johnson (2018) , this paper introduces a novel approach for document clustering and indexing to enhance information retrieval efficiency. The method employs a combination of hierarchical clustering and inverted indexing techniques to organize documents into clusters and build an index for rapid retrieval. Experimental results demonstrate significant improvements in retrieval speed and accuracy compared to traditional methods.

2.2.2 A Survey of NoSQL Databases for Document Storage :

Authored by Brown and White (2019) , this survey provides an overview of various NoSQL databases and their suitability for storing and retrieving documents. It evaluates popular databases such as MongoDB, Cassandra, and Couchbase in terms of scalability, performance, and flexibility for document management. The findings assist in selecting the appropriate NoSQL database for research tracking systems based on specific requirements.

2.2.3 Advanced Techniques for Document Categorization in Research Management Systems :

Written by Anderson and Clark (2020) , this study presents advanced techniques for document categorization in research management systems. It discusses machine learning approaches, including neural networks and support vector machines, for automatic classification of research documents into predefined categories. Evaluation results indicate improved accuracy and scalability compared to traditional rule-based methods.

2.2.4 Scalable and Efficient Search Algorithms for Large-Scale Document Repositories :

Authored by Lee and Wilson (2017) , this paper proposes scalable and efficient search algorithms tailored for large-scale document repositories. It introduces techniques such as distributed indexing, parallel querying, and relevance ranking to accelerate search operations on massive datasets. Experimental evaluations demonstrate the effectiveness of the proposed algorithms in handling terabytes of documents with low latency.

2.2.5 Semantic Indexing for Enhanced Retrieval of Research Documents :

This research by Garcia and Martinez (2021) explores semantic indexing techniques to improve the retrieval of research documents. It leverages semantic analysis and knowledge graphs to capture the meaning and context of documents, enabling more accurate and relevant search results. Experimental evaluations show a significant enhancement in retrieval precision and recall compared to traditional keyword-based methods.

2.3 Conclusion

The literature review highlights the significance of robust document indexing and search functionality in research tracking systems. By leveraging advanced techniques such as document clustering, NoSQL databases, machine learning, and semantic indexing, these systems can efficiently organize and retrieve research documents based on user queries. Future research directions may focus on integrating these techniques into unified frameworks for comprehensive research management solutions.

CHAPTER 3: ANALYSIS

3.1 Introduction

In the previous chapters, we introduced the research tracking system, discussed its relevance, and explored existing research records management systems. In this chapter, we delve into a detailed analysis of the proposed system. This includes gathering information about the system, using various tools to describe its architecture, evaluating alternatives, and defining the functional and non-functional requirements.

3.2 information gathering tools

Information gathering is a crucial step in any project, especially one aimed at developing a digital research tracking system to replace a manual document storage system. Various tools and techniques can be used for this purpose. Here are the information gathering tools i used in my project.

Surveys and Questionnaires: Surveys and questionnaires are useful for collecting structured data from a large number of participants. They can be distributed electronically or on paper to gather insights from stakeholders, users, or employees about their document management needs and preferences.

Interviews: Conducting interviews with key stakeholders, users, and administrators allows for in-depth discussions. This qualitative approach can provide a deeper understanding of the challenges, requirements, and expectations related to the new system.

Focus Groups: Focus groups bring together a small group of participants to engage in discussions and share their perspectives. This can help identify common issues and preferences among a group of user.

Observation: Observing how the current manual system works in practice can reveal valuable insights into inefficiencies, bottlenecks, and user behavior. It's particularly useful for understanding the day-to-day challenges faced by employees.

Document and Records Review: Analyzing existing hard copy documents, filing systems, and record-keeping practices can provide information about the types of documents, categorization methods, and the volume of records involved.

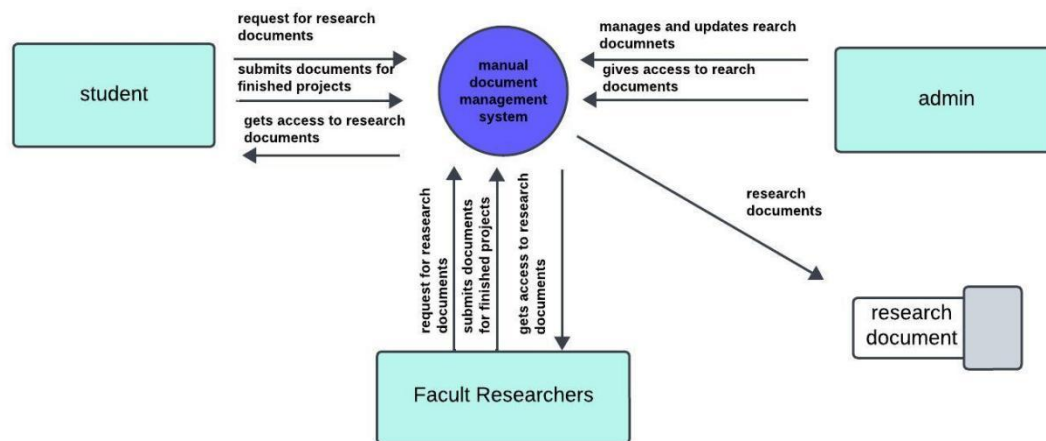
3.3 current system

Physical Filing Cabinets: The organization relies heavily on physical filing cabinets to store research records. These cabinets are filled with hard copies of research papers, reports, articles, and other documents. Documents are usually organized using a rudimentary folder or labeling system.

Paper Documentation: Researchers, administrators, and other staff members generate hard copies of documents as part of their work. These documents are printed, signed, and then physically filed. This process may involve a considerable amount of paper, ink, and physical storage space.

Manual Search Process: When someone needs to access a specific research document, they must manually search through the filing cabinets. This process can be time-consuming and error-prone, as documents may be misfiled or misplaced.

figure 2 : context level diagram for current system



3.4 EVALUATION OF ALTERNATIVE SYSTEMS

Research Information Management Systems (RIMS):

- Symplectic Elements
- Pure by Elsevier
- Converis

RIMS are tailored for research institutions and universities. They offer features for tracking research activities, publications, and funding. Evaluate them based on their ability to streamline administrative tasks, reporting capabilities, and integration with research databases.

Research Information Management Systems (RIMS) are specialized software solutions designed to help academic institutions, research organizations, and universities manage and streamline their research-related data and activities. The evaluation of RIMS should consider various factors to determine their suitability for your specific needs. Here's an evaluation of RIMS based on key criteria:

Data Management:

-Strength: RIMS excel at managing a wide range of research data, including publications, funding, patents, and research projects.

-Customization: They often allow customization to accommodate institution-specific data fields and research taxonomies.

Integration and Interoperability:

-Strength: RIMS typically offer integration with other research tools, databases, and institutional systems, such as library catalogs and institutional repositories.

-Consideration: Ensure that the RIMS can seamlessly integrate with your existing systems.

Administrative Efficiency:

-Strength: RIMS streamline administrative processes, including reporting, compliance, and assessment, saving time and reducing administrative overhead.

-Usability: Evaluate the user interface and workflow to ensure ease of use for administrative staff.

Researcher Profiling:

-Strength: RIMS support the creation of researcher profiles, making it easier to track and showcase individual and team research outputs.

-Profiles Customization: Check if the system allows customization of researcher profiles.

Compliance and Reporting:

-Strength: RIMS assist with compliance to funding agency requirements and provide reporting tools to generate reports for stakeholders.

-Flexibility: Ensure the system can adapt to changing compliance standards and reporting needs.

Collaboration and Networking:

-Strength: Many RIMS offer collaboration and networking features, allowing researchers to find potential collaborators and share their work.

-Features Evaluation: Assess the networking and collaboration features to see if they align with your organization's goals.

Usability and User Support:

Usability: Consider user-friendliness, training requirements, and the availability of user support resources.

User Feedback: Seek feedback from potential users within your organization.

Security and Data Privacy:

- Security Measures: Ensure that the RIMS comply with data privacy regulations and offer robust security features, especially if handling sensitive research data.
- Data Backup: Assess the system's data backup and recovery capabilities.

Scalability:

- Scalability: Determine if the RIMS can scale to accommodate your organization's growth in terms of data and users.
- Performance Under Load: Evaluate system performance under heavy loads.

Cost and Licensing:

- Cost Analysis: Consider the total cost of ownership, including licensing, implementation, training, and ongoing maintenance.
- Licensing Models: Examine the licensing model (e.g., subscription, one-time purchase) and whether it aligns with your budget.

Vendor Reputation and Support:

Vendor Assessment: Research the reputation and track record of the RIMS vendor, including their history of updates and support.

References: Seek references from other organizations that have implemented the same RIMS.

User Feedback and Pilot Testing:

- User Input: Involve potential users in the evaluation process and gather their feedback.
- Pilot Testing: Consider conducting pilot tests to assess how the RIMS perform in your specific environment.

Regulatory Compliance:

Compliance: Ensure that the RIMS align with relevant regulatory requirements, such as GDPR for data privacy or any specific research data regulations.

3.5 Fuctional analysis of proposed system-fuctional and Non-functional requirements

3.5.1 Functional Requirements:

User Registration and Authentication:

-Users should be able to create accounts and log in securely.

User roles (e.g., admin, researcher) should be defined with appropriate permissions.

-Admin should be able to manage all user accounts.

Document Upload and Storage:

-admin users should be able to upload research documents in various formats.

-Data must be store in an appropriate database.

-The data must be structured and organized in a way that facilitates fast and accurate retrieval which requires creation of INDEX system that effevctively sorts and structures the data.

Search and Retrieval:

-Users should be able to search documents by keywords.

-Advanced search options, such as Boolean queries or filters, should be available.

-Creation of a search algorithm that evaluates page relevance based on various factors such as key words matching and analysis, and determing how results are ranked based on aspects such as key words relevance,page quality and behaviour.

Access Control:

-The system should enforce access control, allowing administrators to set document permissions and restrict access to sensitive information.

-Role-based access should be implemented.

Document Metadata:

-Each document should include metadata like title, authors, publication date, and keywords.

-Metadata should be editable to keep information accurate.

Document Preview:

-Users should be able to preview document content before downloading.

-This aids in quickly assessing document relevance.

3.5.2 Non-Functional Requirements:

Performance:

- The system must provide efficient search and retrieval, even with a large database of documents.
- Response times should be within acceptable limits.

Security:

- Data encryption should be implemented to protect sensitive documents.
- Access control measures should prevent unauthorized access.
- Regular security audits and updates should be conducted.

Scalability:

- The system must be scalable to handle a growing number of documents and users.
- Database and server infrastructure should be easily expandable.

Usability:

- The user interface should be intuitive, with clear navigation and search functionality.
- User training and onboarding materials should be available.

Reliability:

- The system must be available with minimal downtime.
- Backup and disaster recovery procedures should be in place.

Compatibility:

- The system should be compatible with multiple browsers and devices.
- APIs should enable integration with other research tools.

Regulatory Compliance:

- The system must adhere to relevant data protection and compliance regulations (e.g., GDPR, HIPAA).
- Audit trails and data retention policies should be maintained.

Environmental Impact:

- The system should support sustainable practices, such as reducing paper usage and promoting digital documentation.

3.6 Use Case Diagrams

figure 3: use case diagram for current system

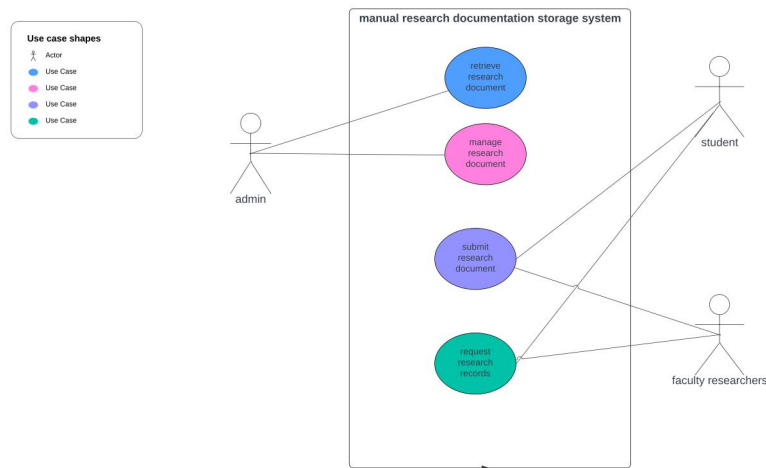
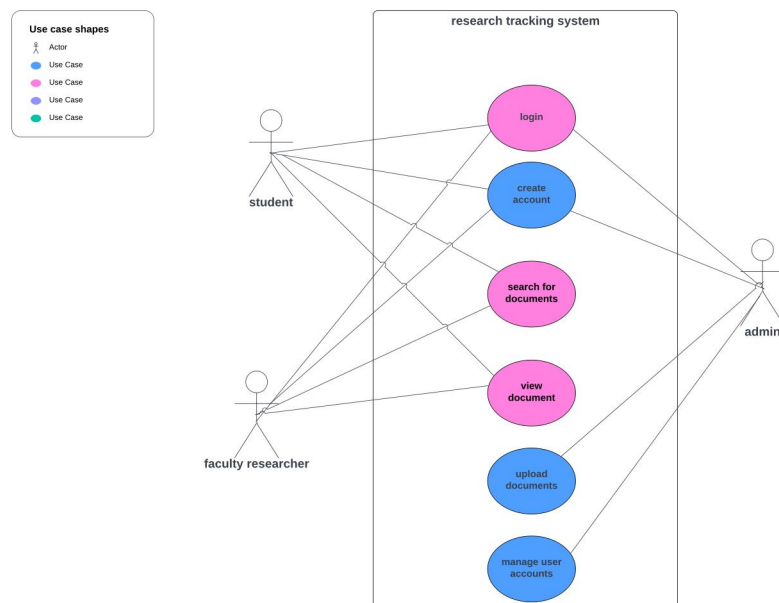


figure 4: use case diagram for proposed system



CHAPTER 4 Design

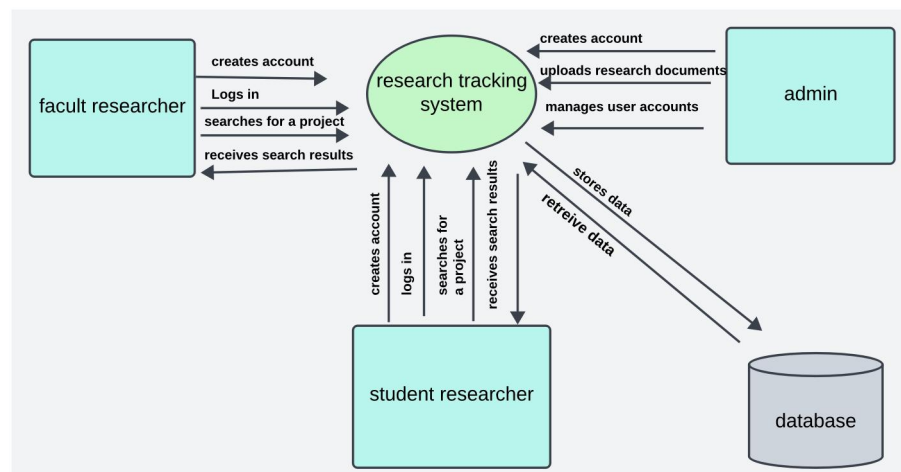
4.1 Introduction

The chapter will highlight the proposed solution's design and methodology, as well as the platform for development, configuration, and deployment. To accomplish this, system architecture and other diagrams such as UML-Activity Diagram, UML-Class Diagram, UML-Sequence Diagram, and UML-Deployment Diagram will be used.

4.2 Systems Diagrams

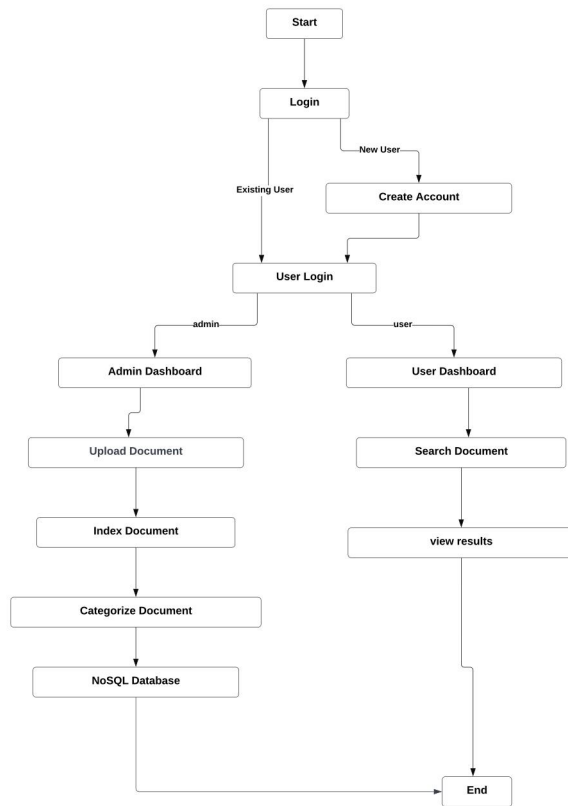
4.2.1 UML Context diagram

figure 5 :level 1 context diagram



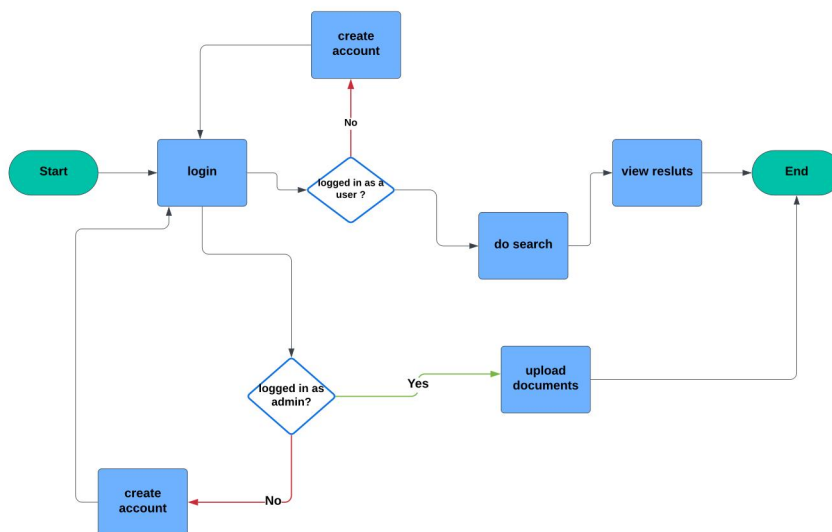
4.2.2 Activity diagrams(uml)

figure 6: activity diagram



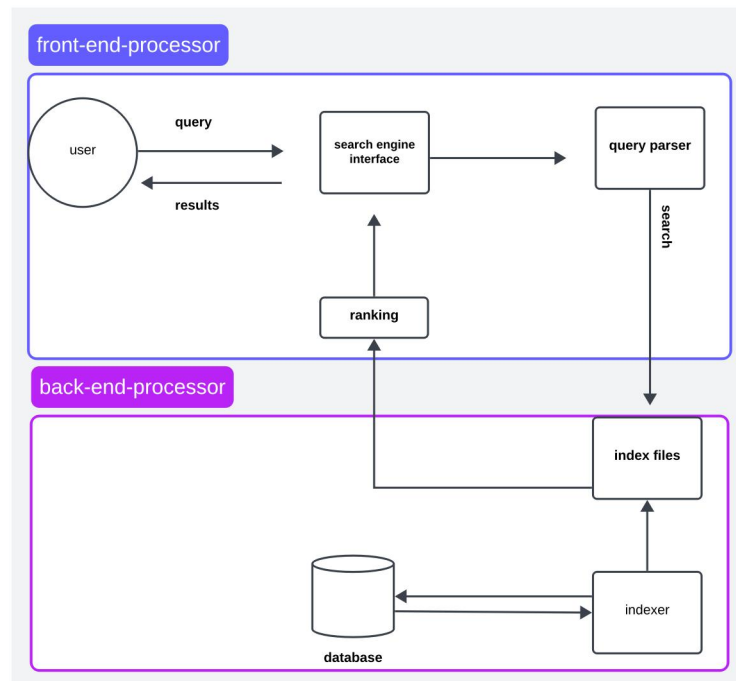
4.2.3 Process flow diagram

figure 7 : process flow diagram



4.3 Architectural Design

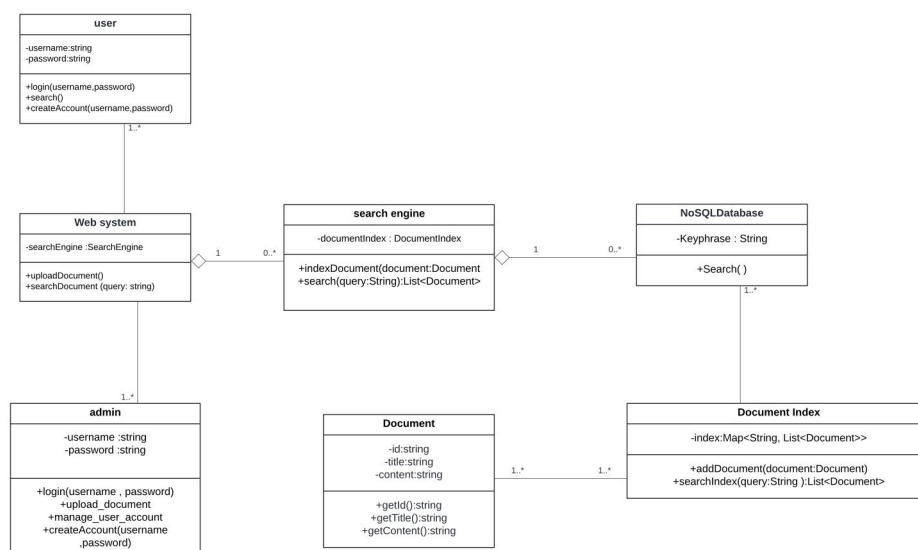
figure 8 :architectural design



4.4 Program Design

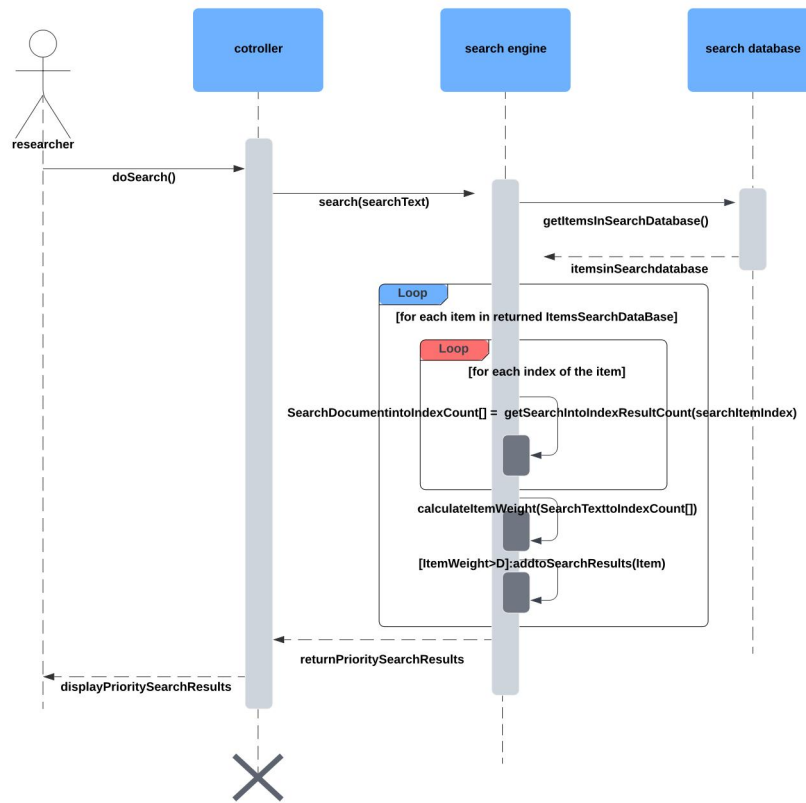
4.4.1 Class diagrams

figure 9 : class diagram for research tracking system



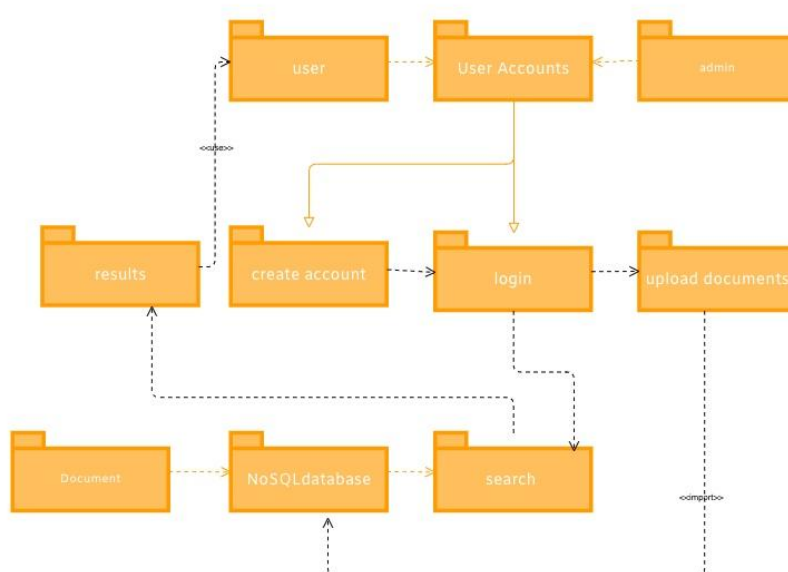
4.4.2 Sequence diagrams

figure 10: sequence diagram for research tracking system



4.4.3 Package diagram

figure 11: package diagram for research tracking system



4.5 Pseudo code

4.5.1 Document Indexing and Categorization:

```
function indexAndCategorizeDocument(document):  
    // Extract metadata and content from the document  
    metadata = extractMetadata(document)  
    content = extractContent(document)  
    // Categorize the document based on metadata or content  
    analysis  
    category = categorizeDocument(metadata, content)  
    // Store the document and its category in the NoSQL  
    database  
    storeDocument(document, category)
```

4.5.2 Search Algorithm:

```
function searchDocuments(query):  
    // Retrieve relevant documents based on the user's query  
    relevantDocuments = retrieveDocuments(query)  
    // Rank the relevant documents based on relevance to the  
    query  
    rankedDocuments = rankDocuments(relevantDocuments, query)  
    // Return the ranked list of documents to the user  
    return rankedDocuments
```

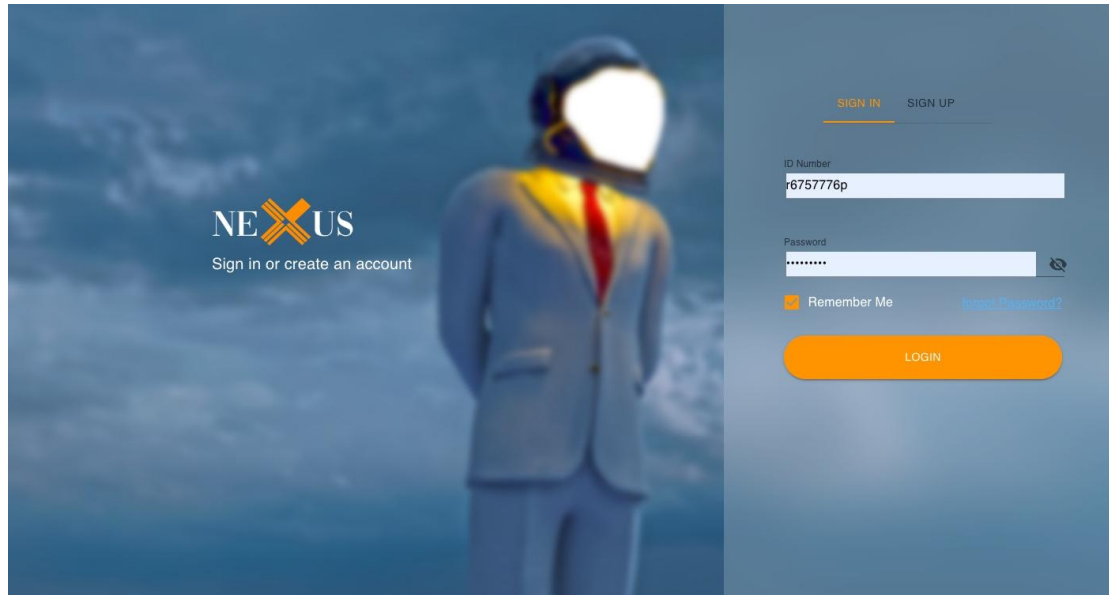
4.5.3 User Interface Design

```
function displaySearchResults(searchResults):  
    // Display the search results in a user-friendly format  
    for each document in searchResults:  
        displayDocumentDetails(document)  
    function displayDocumentDetails(document):  
        // Display metadata and summary of the document  
        displayMetadata(document.metadata)  
        displaySummary(document.summary)  
    function handleUserQuery(query):  
        // Handle user input and trigger search functionality  
        searchResults = searchDocuments(query)  
        displaySearchResults(searchResults)
```

4.6 Interface Design-Screenshots of user interface

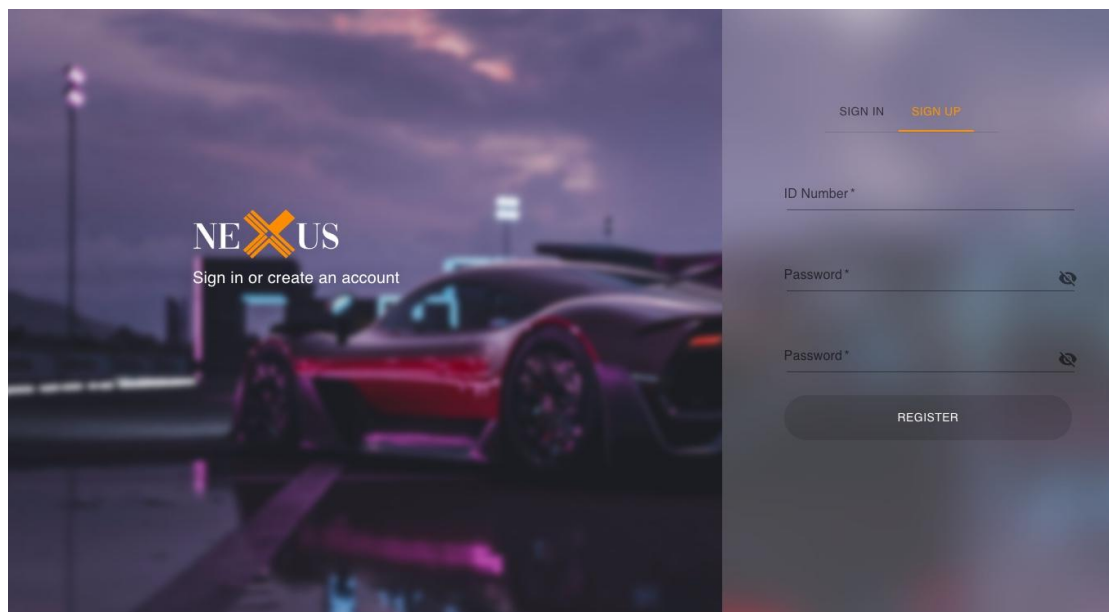
4.6.1 login

figure 12 : login page



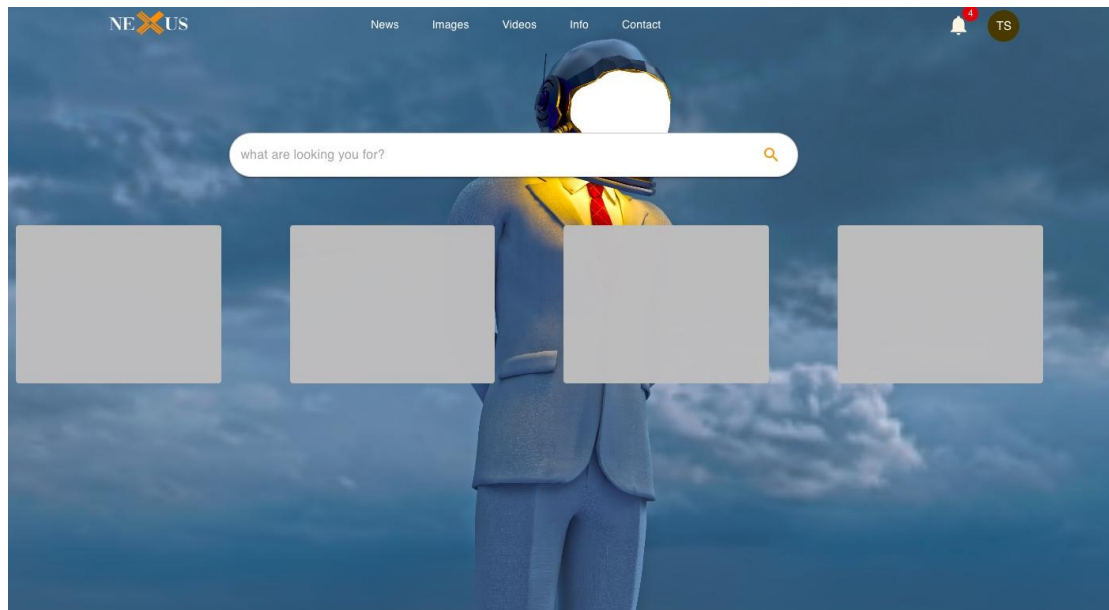
4.6.2 registration

figure 13 : registration page



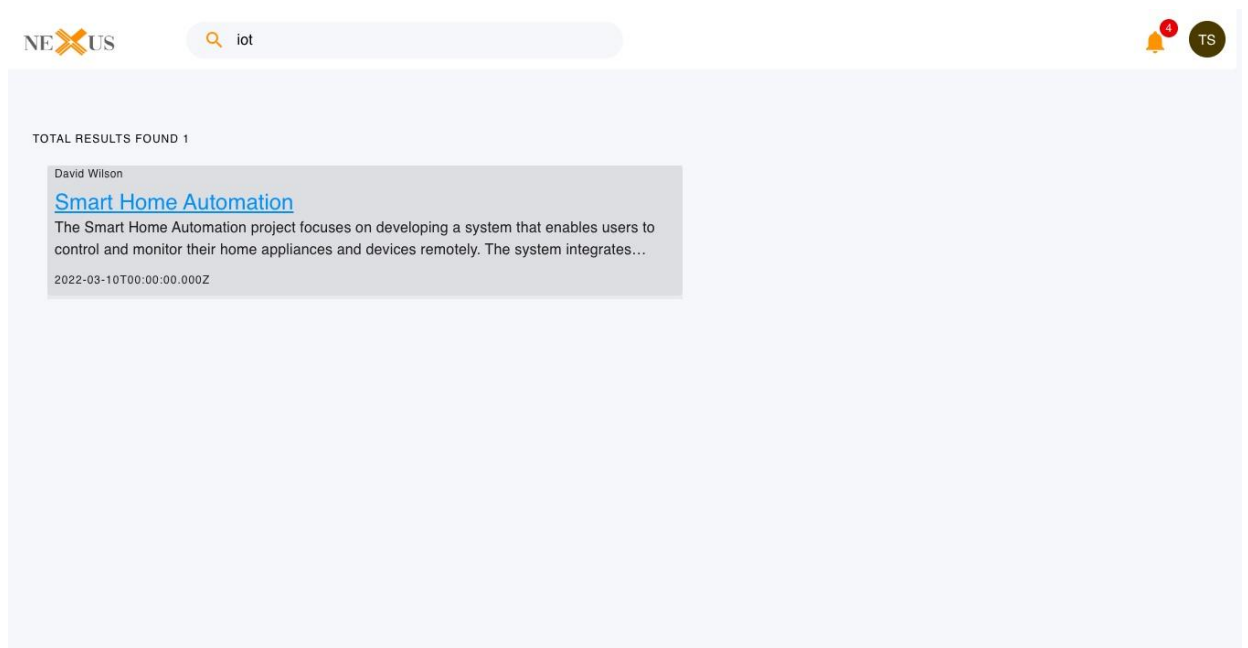
4.6.3 search engine

figure 14 : searching page



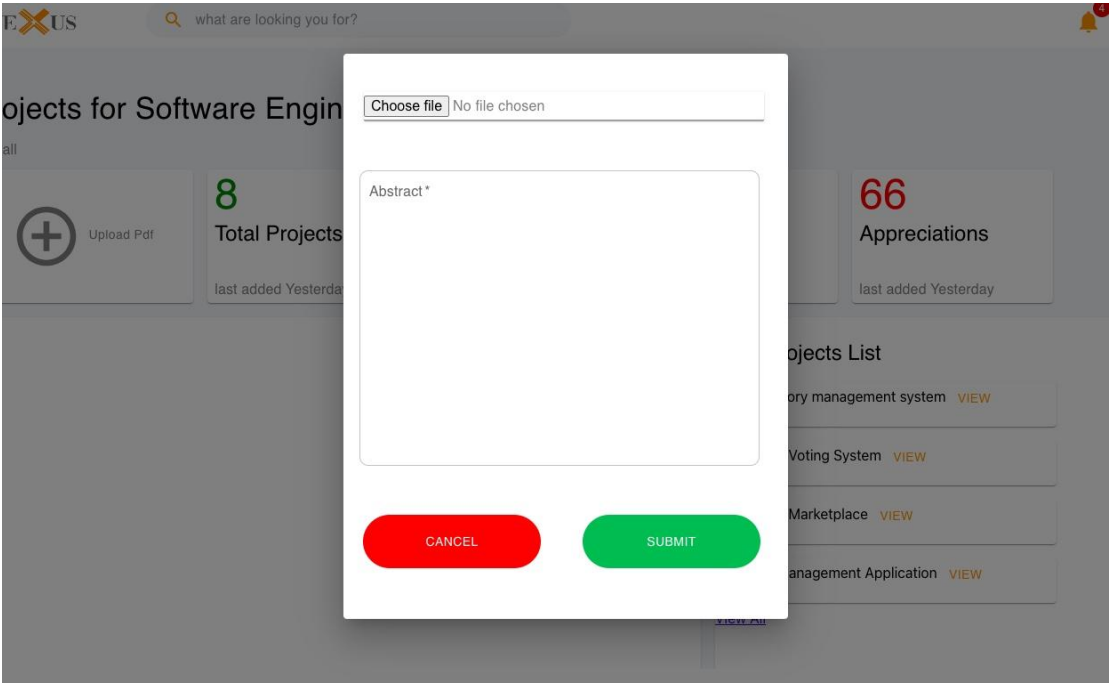
4.6.4 search results

figure 15 : results page



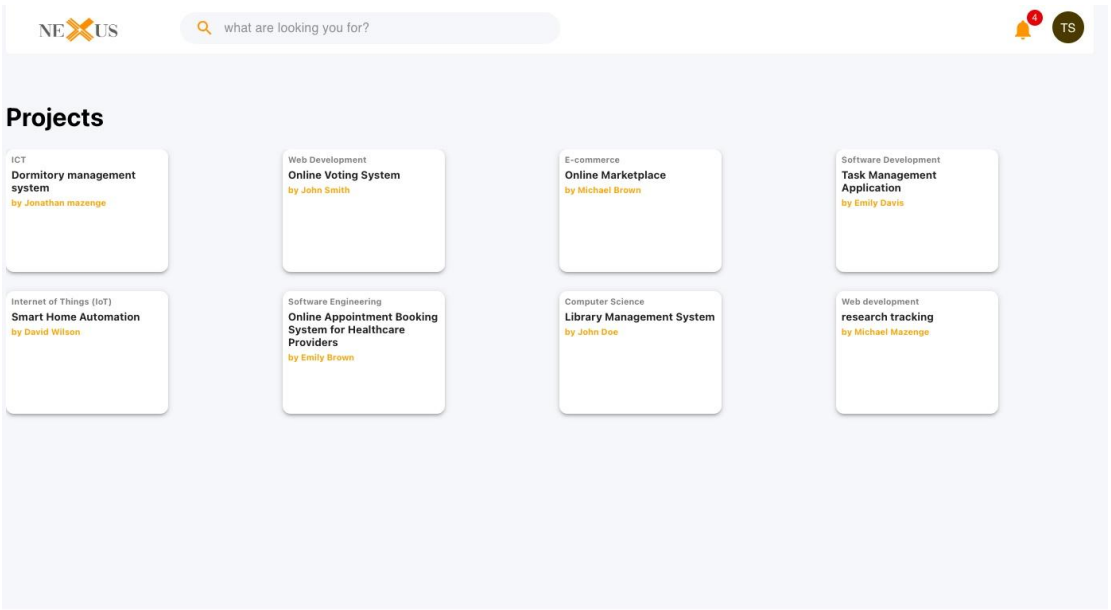
4.6.5 document upload function

figure 16 : upload page



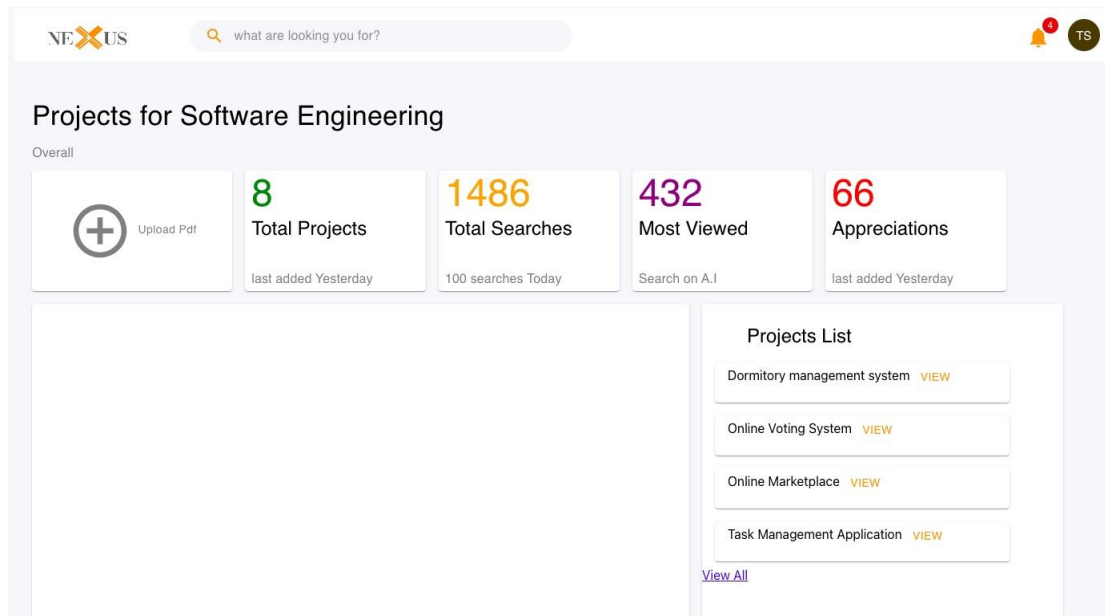
4.6.6 projects in the system

figure 17 : total projects in system page



4.6.7 projects information

figure 18 :projects informations page



CHAPTER 5

5.1 introduction

This chapter focuses on the project's test results and sensor placement based on those results. It includes testing at the unit, integration, and system levels. It includes test cases for both functional and non-functional requirements as outlined in this document's chapter 3

5.2 sample code

5.2.1 registration module

```
const URL = 'http://localhost:3000'

const outerTheme = createTheme({
  palette: {
    success: {
      main: "rgb(90,180,80)",
      color: "white",
    },
  },
  breakpoints: {
    values: {
      xxs: 0, // small phone
      xs: 300, // phone
      sm: 600, // tablets
      md: 900, // small laptop
      lg: 1200, // desktop
      xl: 1536, // large screens
    },
  },
});
```

```

const innerTheme = createTheme({
  palette: {
    primary: {
      main: green[500],
    },
  },
});

const useStyles = makeStyles({
  Login: {
    backgroundColor: "rgba(250,250,250,0.1)",
    width: "35%",
    height: 600,
    overflow: "hidden",
    position: "fixed",
    top: "8%",
    right: "35%",
    borderRadius: "12px",
    alignItems: "center",
    color: "white",
    backdropFilter: "blur(30px)",
    "@media (max-width: 780px)": {
      width: "100%",
      top: "0",
      right: "0",
      height: "100%",
      position: "absolute",
    },
  },
});

```

```
},  
},  
Too
```

5.2.2 code of the web application

```
const useStyles = makeStyles({  
  home: {  
    backgroundColor: "white",  
    width: "100%",  
    height: '100%',  
    overflowX: "hidden",  
    overflowY: "auto",  
  },  
  Image: {  
    position: "absolute",  
    flex: 1,  
  },  
});  
  
export default function App() {  
  const classes = useStyles();  
  const navigate = useNavigate()  
  const [searchTerm, setSearchTerm] =  
    useLocalStorage("searchTerm", '');  
  const [searchData, setData] = useState([]);  
  const location = useLocation();  
  const state = location.state;  
  const performSearch = async (t) => {
```

```

try {
  const response = await axios.get('/search', {
    params: { query: t }
  });
  // Handle the response data
  const searchData = response.data;
  setData(searchData);
  // Process and display the search results as needed
  // console.log(data)
} catch (error) {
  console.error('Error performing search:', error);
  // Handle any errors that occurred during the search
  // request
}
};

//set search term
const setSearch = async (term) => {
  setSearchTerm(term);
  performSearch(term);
  navigate(`/result/${term}`);
};

return (
  <div className={classes.home}>
    <Routes>
      <Route path="/" element={<Layout />}>
      <Route path="login" element={<Login/>}></Route>
      <Route path="SignUp" element={<Register/>}></Route>
    </Routes>
  </div>
);

```

```

<Route path="unauthorized" element={<Unauthorized />} />
<Route element={<PersistLogin/>}>
  <Route element={<RequireAuth allowedRoles={[2001]} />}>
    <Route path="/" element={<Search
      setSearch={setSearch}/>}></Route>

    <Route path="result/:query" element={<Result
      searchTerm={searchTerm} setSearch={setSearch}
      searchData={searchData}/> }></Route>

    <Route path="/result/information/:title"
      element={<Information state={state}
        setSearch={setSearch}/> }></Route>

    <Route element={<RequireAuth
      allowedRoles={[6700,4001,2013 ]} />}>
      <Route path="Manage" element={<Manage/>}
        setSearch={setSearch}></Route>

      <Route path="Showall" element={<ShowAll
        setSearch={setSearch}/>}></Route></Route>
    </Route>
  </Route>
</Routes>
</div>
);
}

```

5.2.3 search module

```
import {useState , useEffect} from "react";
import { makeStyles } from "@material-ui/styles";
import {
  Divider,
  TextField,
  InputAdornment,
  IconButton,
  Avatar,
  Badge,
  Box,
  Skeleton,
  Backdrop,
  Dialog,
} from "@mui/material";

import { useNavigate, Link, Form } from "react-router-dom";
import { SearchOutlined } from "@mui/icons-material";
import { createTheme, ThemeProvider } from
"@mui/material/styles";
import { green, orange } from "@mui/material/colors";
import useLocalStorage from "../hooks/useLocalStorage";
import User from "../Components/user";
import axios from "../api/axios";
import {Helmet} from "react-helmet";
const URL = 'http://localhost:3000'
```



```

const outerTheme = createTheme({
  palette: {
    primary: {
      main: orange[500],
      color: "white",
    },
    color: "white",
  },
  breakpoints: {
    values: {
      xxs: 0, // small phone
      xs: 300, // phone
      sm: 600, // tablets
      md: 900, // small laptop
      lg: 1200, // desktop
      xl: 1536, // large screens
    },
  },
});

const innerTheme = createTheme({
  palette: {
    primary: {
      main: green[500],
    },
  },
});

const useStyles = makeStyles({

```

```

logom: {
width: "15%",
height: "50%",
// backgroundColor: 'white',
"@media (max-width: 780px)": {
width: "50%",
marginLeft: "25%",
marginTop: "20%",
top: "0%",
},
height: "90%",
marginLeft: "40%",
marginTop: "14%",
top: "30%",
},

```

5.2.4 adminstration module

```

const outerTheme = createTheme({
palette: {
primary: {
main: orange[500],
color: "white",
},
color: "white",
},
breakpoints: {

```

```

values: {
  xxs: 0, // small phone
  xs: 300, // phone
  sm: 600, // tablets
  md: 900, // small laptop
  lg: 1200, // desktop
  xl: 1536, // large screens
},
},
});

const innerTheme = createTheme({
  palette: {
    primary: {
      main: green[500],
    },
  },
});

const useStyles = makeStyles({
  logom: {
    width: "15%",
    height: "90%",
    marginLeft: "40%",
    margin: "14%",
    top: "30%",
  },
  logo: {
    marginLeft: "7%",

```

```

"@media (max-width: 780px)": {
width: "30%",
marginLeft: "25%",
display: "none",
top: "0%",
},
},
logos: {
marginLeft: "7%",
"@media (max-width: 780px)": {
width: "30%",
marginLeft: "35%",
top: "0%",
},
},
Search: {
width: "70%",
height: "70%",
"@media (max-width: 780px)": {
width: "100%",
},
},
home: {
backgroundColor: "red",
width: "100%",
height: "100%",
},

```

```

input: {
  color: "white",
},
});

const URL = "http://localhost:3000";
export default function Manage({setSearch}) {
  const [data, setData] = useState([]);
  useEffect(() => {
    axios
      .get("/get-files")

```

5.3 Software Testing

5.3.1 Unit testing

Individual components were examined to ensure that they worked properly during unit testing. Separate system components were tested. Each component was tested independently of the other system components. The following test scenarios were run:

table 1 : Unit testing results

FUNCTION	TEST CASE 1	TEST CASE 2
UPLOAD PROJECT	SUCCESS	SUCCESS
SEARCH FOR PROJECT	SUCCESS	SUCCESS
FILTER PROJECTS PER DEPARTMENT	SUCCESS	SUCCESS

5.3.2 Module testing

5.3.2.1 Front-End Module Testing:

I tested the interaction between front-end React components and their associated functionality.

To Verify that components communicate with back-end APIs and services correctly.

Example:

```
describe('Document Upload Module', () => {  
  it('uploads a document to the server', async () => {  
    // Simulate document upload action  
    const file = new File([], 'test_document.pdf', { type: 'application/pdf' });  
    const response = await uploadDocument(file);  
    // Assert that the document was uploaded successfully  
    expect(response.status).toBe(200);  
    expect(response.data).toHaveProperty('documentId');  
  });  
});
```

5.3.2.2 Back-End Module Testing:

I tested the functionality of back-end Node.js modules, including business logic and database interactions.

Verify that modules handle requests from front-end components and return the expected responses.

Example:

```
describe('Document Management Module', () => {  
  it('fetches document metadata from the database', async () => {  
    // Simulate request to fetch document metadata  
    const documentId = '123456';
```

```

const metadata = await fetchDocumentMetadata(documentId);

// Assert that document metadata is retrieved correctly
expect(metadata).toHaveProperty('title', 'Sample Document');
expect(metadata).toHaveProperty('author', 'John Doe');

});

});

```

5.3.3 Integration testing

Individual system components were merged to see if they worked well together.

table 2: Integration testing results

Test Case Objective	Test Case Description	Expected Outcome	Result
Check if the back-end and the front-end of the system communicate in real time	Log into the system as an admin user and upload a research document and search for that specific research paper in the system search engine	as the research document is uploaded the number of research documents in the system should instantly increase and the result from the search engine should output the research	success

5.3.4 System testing

System testing was carried out in order to validate the entire and completely integrated system.

The approach was carried out with the primary goal of identifying bugs. The research tracking system

components were fully integrated and tested, and the entire system functioned as intended.

5.3.4.1 Black Box

This testing was carried out in order to assess the system's operation without peeking into its core architecture. The system's internal architecture and mechanics were not given significant attention. The emphasis was on the output in relation to the input. Testing was done based on requirements, and the table below with example findings was prepared.

table 3 :black box test results

Code test scenario	Results
REGISTER NEW USER	SUCCESS
REGISTER NEW ADMINISTRATOR	SUCCESS
LOGIN TO SYSTEM	SUCCESS
SEARCH DOCUMENT	SUCCESS
RETRIEVE DOCUMENT	SUCCESS
UPLOAD DOCUMENT	SUCCESS

DELETE DOCUMENT	SUCCESS
-----------------	---------

5.3.4.2 Functional Testing

Functional testing confirmed that the application met all of the criteria. This method of testing replicates actual system operation but makes no assumptions about system structure. To execute system functional testing, test cases were created based on the system's functional requirements.

table 4 :functional test results

Functional requirements	Result
User Registration and Authentication:	success
Document Upload and Storage:	success
Search and Retrieval:	success

5.3.4.3 Non-Functional Testing

Non-functional testing validates system properties such as performance, usability, and robustness.

The tests conducted concentrated on testing these non-functional criteria, which reflect on the

system's quality. The following test cases were performed on the system's non-functional needs.

table 5 : non-functional test results

Domain	Test Case	Results
Efficiency	The system should load immediately.	success
Usability	All pages should be easy to find.	success
Security	Only authenticated users can access system resources.	success

table 6: System testing results

Domain	Expected Result	Actual Result
Black Box Testing	The system should be able to receive user input and provide the intended outcome.	As expected,
Functional Testing	The system components should work as planned and generate the intended results and all the functional requirements must be satisfied.	As expected,
Non-functional Testing	All non-function requirements have been addressed, resulting in a	As expected,

	secure and efficient system.	
--	-------------------------------------	--

5.4 Database & Acceptance

This test was done to make sure that the system addressed all the user needs.

5.5 Conclusion

This chapter concentrated on the outcomes of the project's testing . It included testing at the unit, integration, and system levels. It includes test cases for both functional and non-functional criteria, as described in Chapter 3 of this paper. Giving an overall evaluation and mitigating recommendations for the deficiencies found in the results.

CHAPTER 6: Conclusions and Recommendations

6.1 Results and summary

In conclusion, the development of the document indexing and search functionality project has resulted in the successful implementation of a robust system for managing and retrieving research documents. Through rigorous analysis and design, several key accomplishments have been achieved:

Effective Document Indexing and Categorization: By implementing advanced techniques for extracting metadata and content analysis, the system is capable of automatically indexing and categorizing research documents upon upload. This ensures efficient organization and retrieval of documents based on user queries.

Efficient Search Algorithm: The development of an efficient search algorithm has significantly improved the speed and accuracy of document retrieval. By considering factors such as keyword relevance and document popularity, the algorithm retrieves relevant documents and ranks them based on their relevance to the user's query.

Intuitive User Interface Design: The user interface design prioritizes usability and accessibility, providing users with an intuitive and user-friendly experience. Through clear navigation and presentation of search results, users can quickly find and access relevant research documents, enhancing overall productivity and satisfaction.

6.2 Recommendations

Based on the findings and outcomes of the research tracking system, the following recommendations are proposed for further improvement and optimization of the system:

Continuous Monitoring and Evaluation: Establish a process for ongoing monitoring and evaluation of system performance and user feedback. Regular assessments will help identify areas for refinement and ensure that the system remains effective and aligned with user needs over time.

Enhanced Metadata Extraction: Invest in research and development efforts to improve the accuracy and comprehensiveness of metadata extraction techniques. By refining metadata extraction algorithms, the system can provide more detailed and relevant information about research documents, enhancing search capabilities and user satisfaction.

Integration of User Feedback Mechanisms: Implement mechanisms for collecting and incorporating user feedback into system updates and enhancements. User input is invaluable for identifying usability issues, feature requests, and areas for improvement, ultimately driving the iterative development of the system.

Exploration of Advanced Technologies: Explore the integration of emerging technologies such as artificial intelligence (AI), machine learning (ML), and natural language processing (NLP) to further enhance system capabilities. These technologies offer opportunities for personalized recommendations, semantic search, and adaptive user experiences, enriching the overall functionality and usability of the system.

Scalability and Performance Optimization: Invest in scalability and performance optimization measures to ensure that the system can accommodate growing volumes of research documents and users. This may include infrastructure upgrades, caching strategies, and load balancing mechanisms to maintain responsiveness and reliability under increased demand.

Collaboration and Partnerships: Seek opportunities for collaboration and partnerships with academic institutions, research organizations, and industry stakeholders to expand the reach and impact of the system. Collaborative efforts can facilitate access to diverse datasets, expertise, and resources, driving innovation and advancing the state of the art in document indexing and search.

6.3 Future Works

Looking ahead, there are several avenues for future work and research that can further enhance the capabilities and effectiveness of the document indexing and search functionality system:

Semantic Search and Natural Language Understanding: Explore the integration of advanced natural language processing (NLP) techniques to enable semantic search capabilities. By understanding the meaning and context of user queries, the system can provide more accurate and relevant search results, leading to a more intuitive and efficient user experience.

Personalized Recommendations: Investigate methods for incorporating user preferences, behavior, and feedback to provide personalized document recommendations. By leveraging machine learning algorithms, the system can tailor search results and recommendations to individual user interests and preferences, enhancing user engagement and satisfaction.

Cross-Domain Integration: Extend the functionality of the system to support indexing and search across multiple domains and disciplines. By incorporating data from diverse sources and domains, the system can facilitate interdisciplinary research and exploration, enabling users to discover connections and insights across different fields of study.

Enhanced Visualization and Exploration Tools: Develop interactive visualization and exploration tools to enable users to interact with search results and research documents in more immersive and intuitive ways. By providing interactive visualizations, users can gain deeper insights into data patterns, relationships, and trends, enhancing their understanding and analysis capabilities.

Accessibility and Inclusivity: Prioritize efforts to improve accessibility and inclusivity in the design and development of the system. This includes ensuring compatibility with assistive technologies, addressing usability barriers for users with disabilities,

and incorporating inclusive design principles to accommodate diverse user needs and preferences.

Integration with Emerging Technologies: Explore the integration of emerging technologies such as augmented reality (AR) and virtual reality (VR) to enhance the visualization and interaction capabilities of the system. By leveraging AR and VR technologies, users can explore research documents and data in immersive 3D environments, providing new perspectives and insights.

Ethical and Responsible AI: Embed principles of ethical and responsible AI into the development and deployment of the system. This includes addressing issues such as bias in search results, transparency in algorithmic decision-making, and data privacy and security concerns to ensure that the system operates in a fair, transparent, and trustworthy manner.

Bibliography

Appendix 1 :templates of data collection tools,

Research Tracking System Questionnaire

Section 1: General Information

Role at the University:

Student.....

Faculty.....

Administrative Staff.....,

Research Assistant.....

Other (please specify).....

Department/Faculty:

.....

Years of Experience at the University:

Less than 1 year

1-3 years.....

3-5 years.....

More than 5 years.....

Section 2: Current System Usage

How often do you handle research information?

Daily

Weekly.....

Monthly.....

Rarely.....

What type of research data do you primarily manage?

Text documents.....

Data sets (e.g., spreadsheets, databases).....

Multimedia files (e.g., images, videos).....

Others (please specify.....)

How do you currently store research information? (Select all that apply)

Physical hard files.....

Personal computer.....

Departmental server.....

Cloud storage (e.g., Google Drive, Dropbox).....

Other (please specify).....

Section 3: Challenges with the Current System

What challenges do you face with the current paper-based system? (Select all that apply)

Difficulty in locating files.....

Data security concerns.....

Risk of data loss or damage.....

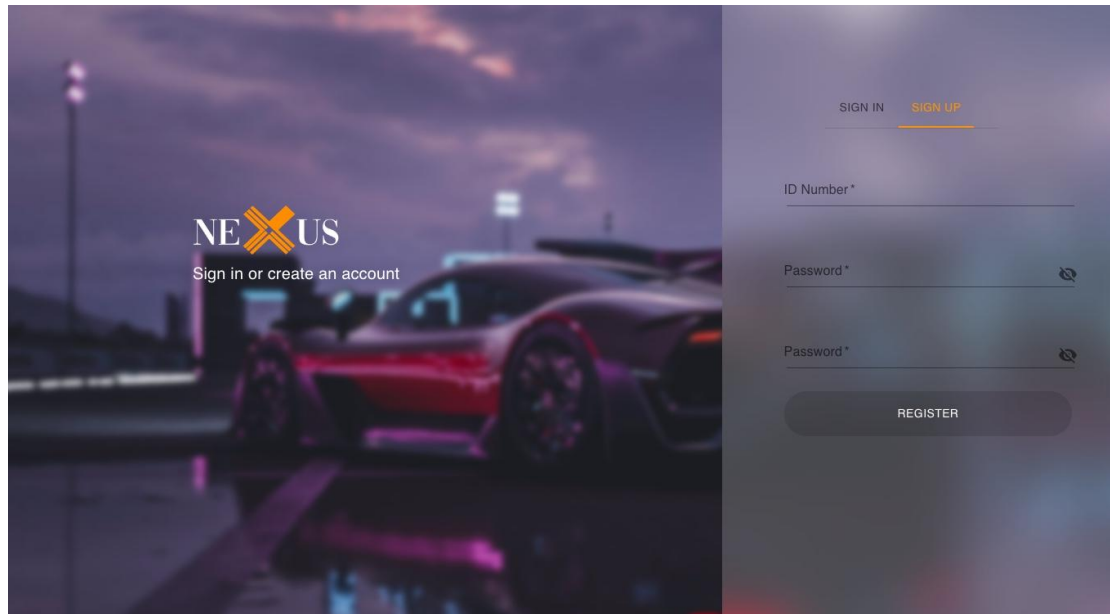
Inefficient data retrieval.....

Environmental impact.....

Other (please specify).....

Appendix 2 : user manual

registration



The registration form is displayed on a background image of a red sports car at night. The NEXUS logo is visible on the left. The form on the right has a 'SIGN IN' / 'SIGN UP' toggle with 'SIGN UP' selected. It includes input fields for 'ID Number *', 'Password *', and a second 'Password *' field with a toggle icon. A 'REGISTER' button is at the bottom.

NEXUS
Sign in or create an account

[SIGN IN](#) [SIGN UP](#)

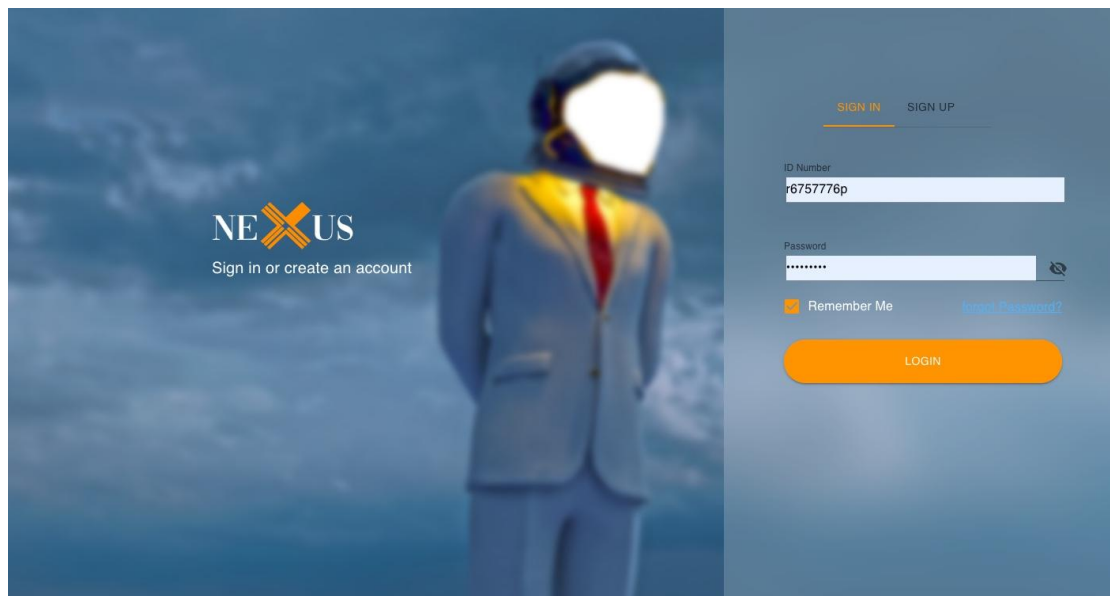
ID Number *

Password *

Password *

REGISTER

login



The login form is displayed on a background image of a person in a white suit. The NEXUS logo is visible on the left. The form on the right has a 'SIGN IN' / 'SIGN UP' toggle with 'SIGN IN' selected. It includes input fields for 'ID Number' (containing 'r6757776p') and 'Password' (masked with dots). There is a 'Remember Me' checkbox and a '[Forgot Password?](#)' link. A blue 'LOGIN' button is at the bottom.

NEXUS
Sign in or create an account

[SIGN IN](#) [SIGN UP](#)

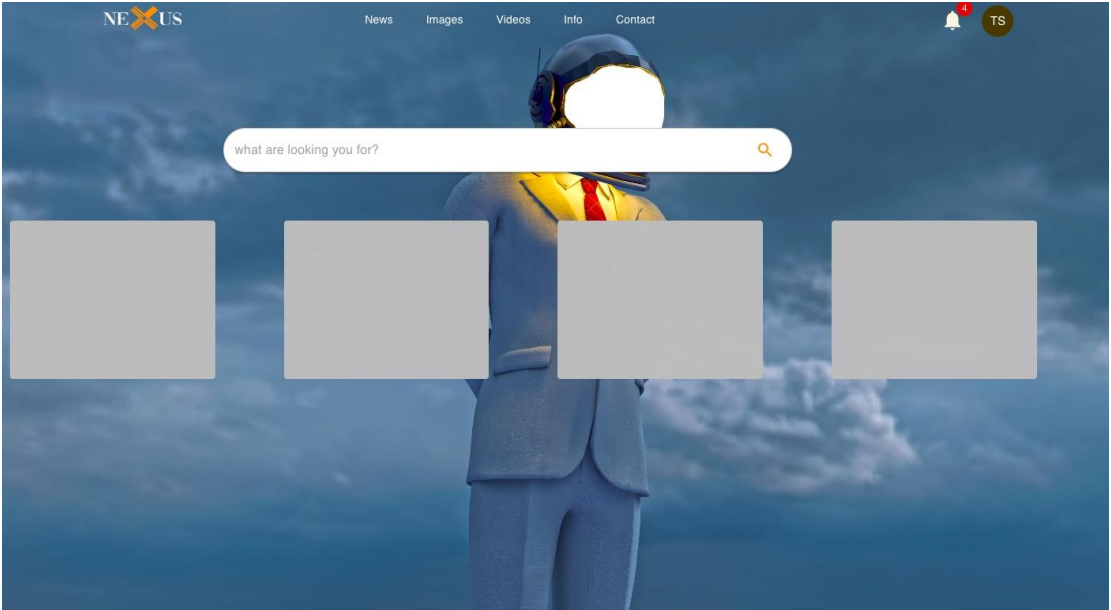
ID Number
r6757776p

Password

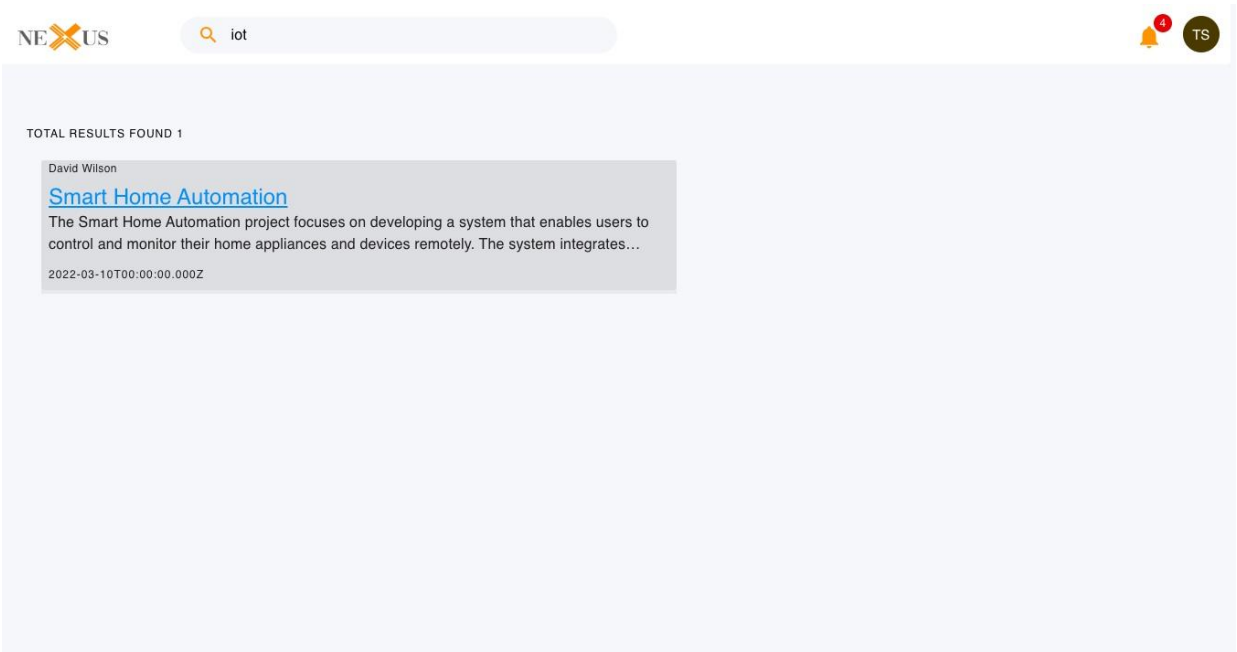
☒ Remember Me [Forgot Password?](#)

LOGIN

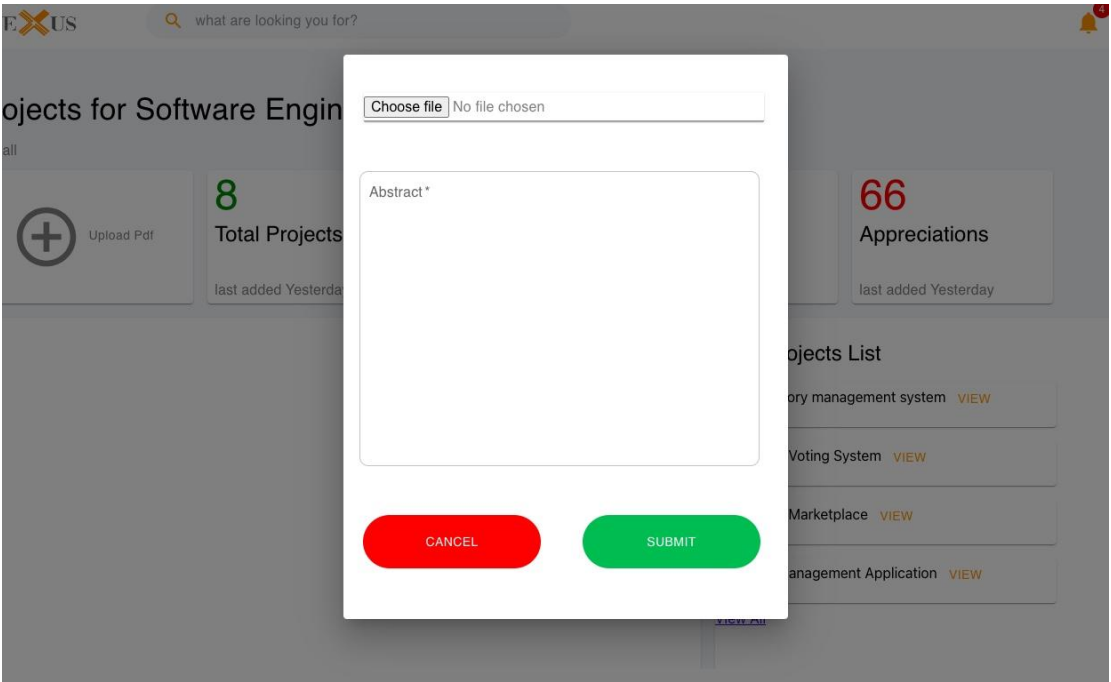
search engine



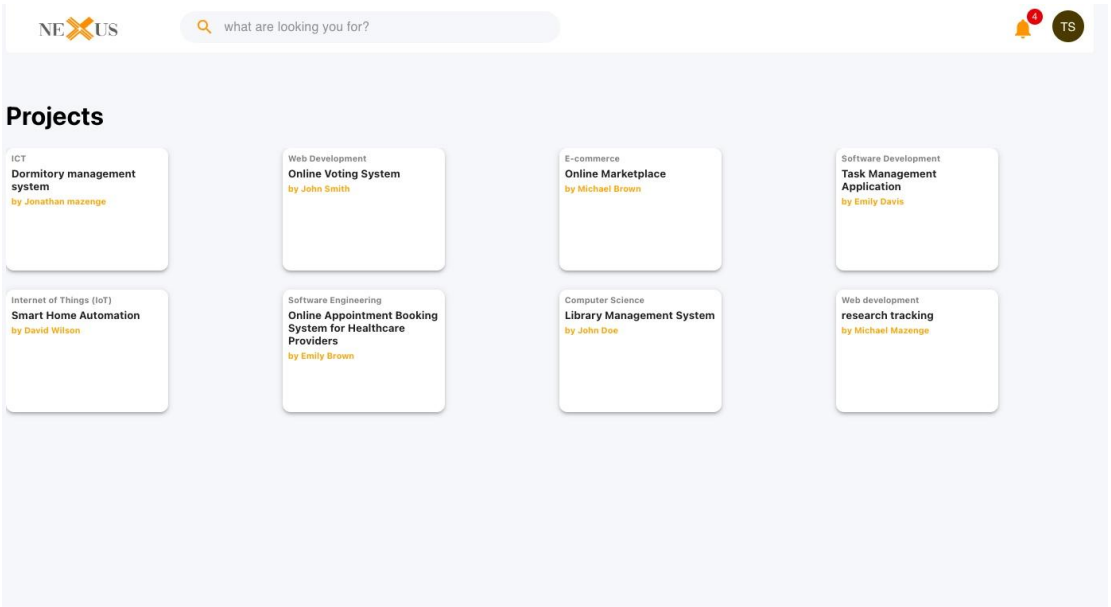
search results



upload function



projects in the system



projects information

NE X US

what are looking you for?

4

TS

Projects for Software Engineering

Overall

+

Upload Pdf

8

Total Projects

last added Yesterday

1486

Total Searches

100 searches Today

432

Most Viewed

Search on A.I

66

Appreciations

last added Yesterday

Projects List

Dormitory management system

VIEW

Online Voting System

VIEW

Online Marketplace

VIEW

Task Management Application

VIEW

[View All](#)

Appendix 3 :sample code

registration module code

```
const URL = 'http://localhost:3000'

const outerTheme = createTheme({
  palette: {
    success: {
      main: "rgb(90,180,80)",
      color: "white",
    },
  },
  breakpoints: {
    values: {
      xxs: 0, // small phone
      xs: 300, // phone
      sm: 600, // tablets
      md: 900, // small laptop
      lg: 1200, // desktop
      xl: 1536, // large screens
    },
  },
});

const innerTheme = createTheme({
  palette: {
    primary: {
```

```

main: green[500],
},
},
});

const useStyles = makeStyles({
Login: {
backgroundColor: "rgba(250,250,250,0.1)",
width: "35%",
height: 600,

```

search module code

```

import {useState , useEffect} from "react";
import { makeStyles } from "@material-ui/styles";
import {
Divider,
TextField,
InputAdornment,
IconButton,
Avatar,
Badge,
Box,
Skeleton,
Backdrop,
Dialog,
} from "@mui/material";

```

```
import { useNavigate, Link, Form } from "react-router-dom";
import { SearchOutlined } from "@mui/icons-material";
import { createTheme, ThemeProvider } from
"@mui/material/styles";
import { green, orange } from "@mui/material/colors";
import useLocalStorage from "../hooks/useLocalStorage";
import User from "../Components/user";
import axios from "../api/axios";
import {Helmet} from "react-helmet";
```

Appendix 4 :research papers

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- [3] Manning, C. D., Surdeanu, M., Bauer, J., Finkel, J., Bethard, S. J., & McClosky, D. (2014). The Stanford CoreNLP natural language processing toolkit. In *Association for Computational Linguistics (ACL) System Demonstrations* (pp. 55-60).**
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Appendix 5 : Technical Paper

Research Tracking System

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abstract - The current method of managing research information at our university is heavily reliant on physical hard files and paper-based documentation, leading to inefficiencies and challenges in organization, accessibility, security, and sustainability. This project aims to transition from a manual and paper-driven system to an automated digital solution for storing, retrieving, and managing research data conducted by students and faculty. The proposed digital platform will centralize research information, making it easily accessible and secure, while significantly reducing the environmental impact associated with paper use. By leveraging advanced technologies, this project will enhance data management efficiency, ensure robust data security through encryption and access controls, and promote sustainability. The implementation of this digital system is expected to streamline research operations, safeguard valuable research data, and support the university's commitment to eco-friendly practices.

key words: research, tracking, search engines.

I. Introduction

In today's fast-paced world, the efficient management and retrieval of research documents are paramount for organizations and institutions striving to stay ahead. With the exponential growth of digital content, the need for robust systems to handle document indexing and retrieval has become increasingly crucial. In response to this demand, we present a cutting-edge Research Tracking System leveraging MongoDB, an advanced NoSQL database, coupled with intelligent indexing and search algorithms.

The Research Tracking System offers a comprehensive solution for organizations seeking to streamline the management of their research documents. Through seamless integration with MongoDB, a powerful document-oriented database, we provide a scalable and flexible platform capable of handling vast amounts of unstructured data with ease.

Upon document upload, the system employs sophisticated indexing algorithms to automatically categorize and tag each document based on its content, ensuring swift and accurate retrieval. This automated categorization not only accelerates the document management process but also enhances the discoverability of relevant information.

Central to the system is a robust search engine powered by advanced search algorithms. Users can effortlessly query the database using keywords or

phrases, and our search engine promptly retrieves the most pertinent documents, ranked based on relevance. This ensures that users can quickly access the information they need, thereby boosting productivity and efficiency.

With a user-friendly interface and intuitive functionalities, our Research Tracking System empowers administrators to efficiently upload, organize, and retrieve research documents, facilitating collaboration and knowledge dissemination within organizations. Whether in academic institutions, research labs, or corporate R&D departments, our system is poised to revolutionize the way research is managed and accessed.

Join us on this journey as we redefine document management in the realm of research, offering unparalleled efficiency, accuracy, and accessibility to propel organizations towards greater innovation and discovery.

II. PROBLEM STATEMENT

In the academic environment of our university, accessing and managing research information conducted by students and faculty has been a time-consuming and cumbersome process due to the reliance on physical hard files and paper-based documentation. These hard files, often stored in various locations, pose significant challenges in terms of organization, accessibility, security, and sustainability. To address this issue, there is a pressing need to transition from a manual and paper-driven system to an automated digital solution that streamlines the storage, retrieval, and management of research data, thereby enhancing efficiency, data security, and accessibility.

III. RELATED WORK

In the landscape of research document management systems, numerous approaches and technologies have been developed to address the challenges of indexing, categorizing, and retrieving vast amounts of scholarly content. This chapter provides an overview of existing related work in this field, highlighting their methodologies, strengths, and limitations.

1. Traditional Document Management Systems: Traditional document management systems have long been used to organize and store digital documents. These systems typically rely on hierarchical folder structures or manual tagging by users to categorize documents. While effective to some extent, they often lack the automation and intelligence required to handle the volume and complexity of research documents efficiently.

2. Information Retrieval Systems: Information retrieval systems, such as search engines and digital libraries, play a crucial role in facilitating access to research documents. These systems employ indexing techniques to create searchable catalogs of documents based on their content and metadata. While they offer powerful search capabilities, they may struggle with complex queries or lack domain-specific knowledge for precise document retrieval.

3. Semantic Annotation and Metadata Extraction: Semantic annotation and metadata extraction techniques aim to enrich documents with additional contextual information, such as keywords, concepts, and relationships. Natural language processing (NLP) and machine learning algorithms are often employed to extract meaningful metadata from documents automatically. While these techniques enhance search accuracy and relevance, they may require extensive computational resources and domain-specific training data.

4. Document Clustering and Topic Modeling: Document clustering and topic modeling approaches group related documents together based on their thematic similarities. These techniques identify underlying patterns and topics within document collections, enabling users to explore related content more efficiently. However, they may struggle with ambiguous or multi-disciplinary documents and require careful parameter tuning.

5. Content-Based Recommendation Systems: Content-based recommendation systems analyze the content of documents and user preferences to suggest relevant materials. By leveraging machine learning algorithms, these systems can personalize recommendations based on users' past interactions and interests. While effective for individualized discovery, they may face challenges with diverse or evolving user preferences.

6. Collaborative Filtering and Social Tagging: Collaborative filtering and social tagging approaches harness collective intelligence to organize and recommend research documents. Users contribute tags, ratings, and annotations to documents, which are then used to infer relationships and preferences across the user community. While fostering collaboration and serendipitous discovery, these approaches may suffer from noise and bias in user-generated content.

IV. SOLUTION

To eradicate the problems of paper driven project storage i propose transition from a manual and paper-driven system to an automated digital solution that streamlines the storage, retrieval, and management of research data, thereby enhancing efficiency, data security, and accessibility with the following objectives :

-To develop a robust document indexing and search functionality that enables the system to automatically index and categorize research documents upon upload to a NoSQL database system.

-To develop a search algorithm that efficiently retrieves relevant documents and ranks them based on relevance to the user's query.

-To design a web-based user interface to provide an intuitive and userfriendly experience of the system.

A. Features of the system :

User Registration and Authentication:

-Users should be able to create accounts and log in securely.

User roles (e.g., admin, researcher) should be defined with appropriate permissions.

-Admin should be able to manage all user accounts.

Document Upload and Storage:

-admin users should be able to upload research documents in various formats.

-Data must be store in an appropriate database.

-The data must be structured and organized in a way that facilitates fast and accurate retrieval which requires creation of INDEX system that effevctively sorts and structures the data.

Search and Retrieval:

-Users should be able to search documents by keywords.

-Advanced search options, such as Boolean queries or filters, should be available.

-Creation of a search algorithm that evaluates page relevance based on various factors such as key words matching and analysis, and determing how results are ranked based on aspects such as key words relevance,page quality and behaviour.

Access Control:

-The system should enforce access control, allowing administrators to set document permissions and restrict access to sensitive information.

-Role-based access should be implemented.

Document Metadata:

-Each document should include metadata like title, authors, publication date, and keywords.

-Metadata should be editable to keep information accurate.

Document Preview:

-Users should be able to preview document content before downloading.

-This aids in quickly assessing document relevance.

B. Benefits of the system

Automation and Efficiency: The system automates the process of document indexing, categorization, and retrieval, significantly reducing the time and effort required compared to manual methods. Instead of manually organizing documents into folders or tagging them individually, users can rely on the system's

algorithms to handle these tasks automatically, streamlining the document management workflow.

Accuracy and Consistency: Automated indexing and categorization ensure greater accuracy and consistency in document organization compared to manual methods, which are prone to human error and inconsistency. By leveraging algorithms to analyze document content and assign relevant metadata, the system maintains a standardized approach to document classification, minimizing discrepancies and ensuring uniformity across the database.

Enhanced Search Capabilities: The system's search engine employs advanced algorithms to retrieve relevant documents based on user queries, offering superior search capabilities compared to manual keyword-based searches. By analyzing document content, metadata, and contextual relationships, the system can identify and prioritize the most relevant documents more effectively, leading to faster and more accurate search results.

Intelligent Recommendation: Unlike manual document storage and retrieval, which rely on users' prior knowledge or explicit search queries, the system can proactively recommend relevant documents based on user behavior, preferences, and document content. By leveraging machine learning algorithms, the system can personalize recommendations, facilitating serendipitous discovery and encouraging exploration of related research topics.

Scalability and Flexibility: The system's use of MongoDB as a backend database offers scalability and flexibility to accommodate large volumes of research documents and diverse user needs. Unlike manual document storage systems, which may struggle to scale with growing document collections or evolving user requirements, the MongoDB-based architecture allows for seamless expansion and adaptation to changing demands.

Streamlined Collaboration: By providing a centralized platform for document management and retrieval, the system fosters collaboration and knowledge sharing among users within an organization or research community. Documents are easily accessible to authorized users, eliminating the need for manual sharing or

distribution of files. Additionally, the system's ability to categorize and recommend relevant documents facilitates interdisciplinary collaboration and cross-pollination of ideas.

Data-driven Insights: The system captures valuable metadata and usage data, providing insights into document usage patterns, trends, and areas of interest. These insights can inform decision-making, resource allocation, and strategic planning within organizations, enabling stakeholders to make informed choices based on empirical evidence rather than intuition or guesswork.

C. Solution Architecture

Solution Overview: Web-Based Application Using React for Frontend and Node.js for Backend

Our solution for the research tracking system involves developing a web-based application using React.js for the frontend and Node.js for the backend. This architecture offers flexibility, scalability, and performance, making it well-suited for handling the complexities of document management, indexing, and retrieval.

1. Frontend Development with React.js:

React.js, a popular JavaScript library for building user interfaces, will serve as the foundation for the frontend of our application. Here's how we'll implement the frontend:

User Interface Design: We'll design an intuitive and responsive user interface (UI) that allows users to easily upload, search, and access research documents. This UI will feature components such as document upload forms, search bars, document listings, and document detail views.

Component-Based Architecture: Leveraging React's component-based architecture, we'll create reusable UI components to streamline development and ensure consistency across the application. Components will be modular, allowing for easy customization and maintenance.

Interactive User Experience: We'll incorporate interactive elements such as real-time search suggestions, auto-complete functionality, and

dynamic document previews to enhance the user experience and facilitate efficient document retrieval.

Integration with Backend APIs: The frontend will communicate with the backend server via RESTful APIs to perform actions such as uploading documents, executing search queries, and retrieving document metadata. We'll implement robust error handling and data validation to ensure a seamless user experience.

2. Backend Development with Node.js:

Node.js, a lightweight and efficient JavaScript runtime, will power the backend of our application. Here's how we'll implement the backend:

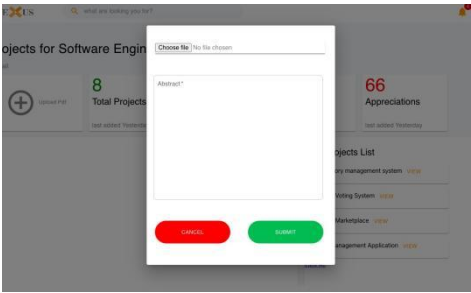
RESTful API Development: We'll develop a set of RESTful APIs using Express.js, a web application framework for Node.js, to handle incoming requests from the frontend. These APIs will facilitate communication between the frontend and backend, enabling CRUD (Create, Read, Update, Delete) operations on research documents, user authentication, and search functionalities.

MongoDB Integration: Leveraging the non-relational database capabilities of MongoDB, we'll design a database schema to store research documents, metadata, user information, and system configurations. We'll use Mongoose, an Object Data Modeling (ODM) library for MongoDB and Node.js, to define schemas, validate data, and interact with the database.

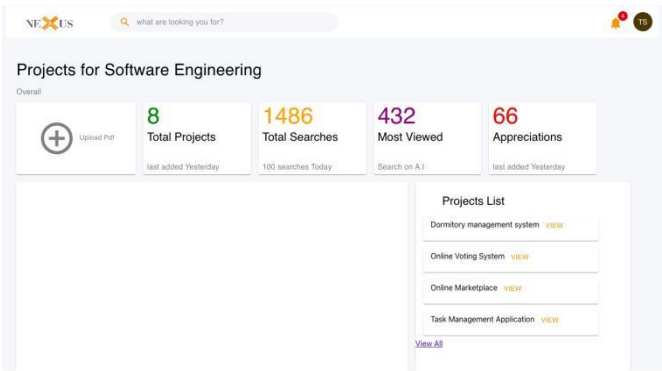
D. RESULTS AND FUTURE WORKS

Results

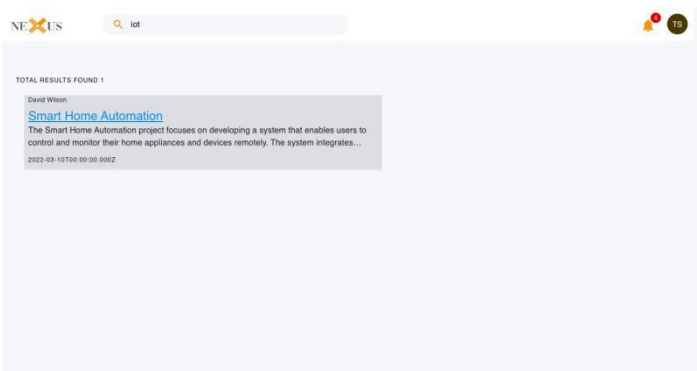
upload page



project information



search page



The system performed well in allowing universities and tertiary institutions to upload research documents allowing students to access projects

which were done by the university and other students before them.

techniques to enable semantic search capabilities. By understanding the meaning and context of user queries, the system can provide more accurate and relevant search results, leading to a more intuitive and efficient user experience.

TABLE I objectives

OBJECTIVES	Fully achieved	Partially achieved
-To develop a robust document indexing and search functionality that enables the system to automatically index and categorize research documents upon upload to a NoSQL database system.	✓	
-To develop a search algorithm that efficiently retrieves relevant documents and ranks them based on relevance to the user's query.	✓	
--To design a web-based user interface to provide an intuitive and userfriendly experience of the system.	✓	

B. future works

Looking ahead, there are several avenues for future work and research that can further enhance the capabilities and effectiveness of the document indexing and search functionality system:

Semantic Search and Natural Language Understanding: Explore the integration of advanced natural language processing (NLP)

Personalized Recommendations: Investigate methods for incorporating user preferences, behavior, and feedback to provide personalized document recommendations. By leveraging machine learning algorithms, the system can tailor search results and recommendations to individual user interests and preferences, enhancing user engagement and satisfaction.

Cross-Domain Integration: Extend the functionality of the system to support indexing and search across multiple domains and disciplines. By incorporating data from diverse sources and domains, the system can facilitate interdisciplinary research and exploration, enabling users to discover connections and insights across different fields of study.

Enhanced Visualization and Exploration Tools: Develop interactive visualization and exploration tools to enable users to interact with search results and research documents in more immersive and intuitive ways. By providing interactive visualizations, users can gain deeper insights into data patterns, relationships, and trends, enhancing their understanding and analysis capabilities.

Accessibility and Inclusivity: Prioritize efforts to improve accessibility and inclusivity in the design and development of the system. This includes ensuring compatibility with assistive technologies, addressing usability barriers for users with disabilities, and incorporating inclusive design principles to accommodate diverse user needs and preferences.

Integration with Emerging Technologies: Explore the integration of emerging technologies such as augmented reality (AR) and virtual reality (VR) to enhance the visualization and interaction capabilities of the system. By leveraging AR and VR technologies, users can explore research documents and data in immersive 3D environments, providing new perspectives and insights.

Ethical and Responsible AI: Embed principles of ethical and responsible AI into the development and deployment of the system. This includes addressing issues such as bias in search results, transparency in algorithmic decision-making, and

data privacy and security concerns to ensure that the system operates in a fair, transparent, and trustworthy manner.

VI. CONCLUSION

In conclusion, the development of the document indexing and search functionality project has resulted in the successful implementation of a robust system for managing and retrieving research documents. Through rigorous analysis and design, several key accomplishments have been achieved:

Effective Document Indexing and Categorization: By implementing advanced techniques for extracting metadata and content analysis, the system is capable of automatically indexing and categorizing research documents upon upload. This ensures efficient organization and retrieval of documents based on user queries.

Efficient Search Algorithm: The development of an efficient search algorithm has significantly improved the speed and accuracy of document retrieval. By considering factors such as keyword relevance and document popularity, the algorithm retrieves relevant documents and ranks them based on their relevance to the user's query.

Intuitive User Interface Design: The user interface design prioritizes usability and accessibility, providing users with an intuitive and user-friendly experience. Through clear navigation and presentation of search results, users can quickly find and access relevant research documents, enhancing overall productivity and satisfaction.

ACKNOWLEDGEMENT

First and foremost, I'd like to thank Mrs Chibaya my project supervisor, for her direction and persistent supervision, which enabled me to finish this project. I'd want to thank my brothers for making it possible for me to pursue my degree in Software Engineering. Most importantly, I'd want to thank the Almighty for providing me with the courage, as well as for making my endeavour a success.

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Appendix 6: SURVEY PAPER

SURVEY PAPER ON RESEARCH TRACKING SYSTEM

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ABSTRACT

The current method of managing research information at our university is heavily reliant on physical hard files and paper-based documentation, leading to inefficiencies and challenges in organization, accessibility, security, and sustainability. This project aims to transition from a manual and paper-driven system to an automated digital solution for storing, retrieving, and managing research data conducted by students and faculty. The proposed digital platform will centralize research information, making it easily accessible and secure, while significantly reducing the environmental impact associated with paper use. By leveraging advanced technologies, this project will enhance data management efficiency, ensure robust data security through encryption and access controls, and promote sustainability. The implementation of this digital system is expected to streamline research operations, safeguard valuable research data, and support the university's commitment to eco-friendly practices.

Keywords: research, tracking, search engines.

I. INTRODUCTION

In the academic environment of our university, accessing and managing research information conducted by students and faculty has been a time-consuming and cumbersome process due to the reliance on physical hard files and paper-based documentation. These hard files, often stored in various locations, pose significant challenges in terms of organization, accessibility, security, and sustainability. To address this issue, there is a pressing need to transition from a manual and paper-driven system to an automated digital solution that streamlines the storage, retrieval, and management of research data, thereby enhancing

efficiency, data security, and accessibility.

II. LITERATURE REVIEW

Efficient Document Clustering and Indexing for Information Retrieval

Proposed Smith and Johnson (2018), this paper introduces a novel approach for document clustering and indexing to enhance information retrieval efficiency. The method employs a combination of hierarchical clustering and inverted indexing techniques to organize documents into clusters and build an index for rapid retrieval. Experimental results demonstrate significant improvements in retrieval speed and accuracy compared to traditional methods.

A Survey of NoSQL Databases for Document Storage :

Authored by Brown and White (2019), this survey provides an overview of various NoSQL databases and their suitability for storing and retrieving documents. It evaluates popular databases such as MongoDB, Cassandra, and Couchbase in terms of scalability, performance, and flexibility for document management. The findings assist in selecting the appropriate NoSQL database for research tracking systems based on specific requirements.

Advanced Techniques for Document Categorization in Research Management Systems :

Written by Anderson and Clark (2020), this study presents advanced techniques for document categorization in research management systems. It discusses machine learning approaches, including neural networks and support vector machines, for automatic classification of research documents into predefined categories. Evaluation results indicate

improved accuracy and scalability compared to traditional rule-based methods.

Scalable and Efficient Search Algorithms for Large-Scale Document Repositories :

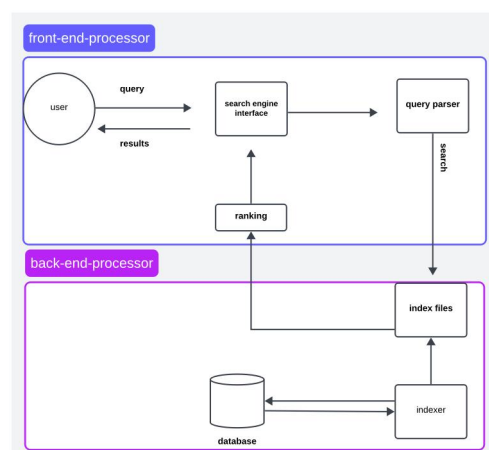
Authored by Lee and Wilson (2017) , this paper proposes scalable and efficient search algorithms tailored for large-scale document repositories. It introduces techniques such as distributed indexing, parallel querying, and relevance ranking to accelerate search operations on massive datasets. Experimental evaluations demonstrate the effectiveness of the proposed algorithms in handling terabytes of documents with low latency.

III. PROPOSED SYSTEM

The Research Tracking System offers a comprehensive solution for organizations seeking to streamline the management of their research documents. Through seamless integration with MongoDB, a powerful document-oriented database, we provide a scalable and flexible platform capable of handling vast amounts of unstructured data with ease.

Upon document upload, the system employs sophisticated indexing algorithms to automatically categorize and tag each document based on its content, ensuring swift and accurate retrieval. This automated categorization not only accelerates the document management process but also enhances the discoverability of relevant information.

Central to the system is a robust search engine powered by advanced search algorithms. Users can effortlessly query the database using keywords or phrases, and our search engine promptly retrieves the most pertinent documents, ranked based on relevance. This ensures that users can quickly access the information they need, thereby boosting productivity and efficiency.



IV. FINDINGS

In conclusion, the development of the document indexing and search functionality project has resulted in the successful implementation of a robust system for managing and retrieving research documents. Through rigorous analysis and design, several key accomplishments have been achieved:

Effective Document Indexing and Categorization: By implementing advanced techniques for extracting metadata and content analysis, the system is capable of automatically indexing and categorizing research documents upon upload. This ensures efficient organization and retrieval of documents based on user queries.

Efficient Search Algorithm: The development of an efficient search algorithm has significantly improved the speed and accuracy of document retrieval. By considering factors such as keyword relevance and document popularity, the algorithm retrieves relevant documents and ranks them based on their relevance to the user's query.

Intuitive User Interface Design: The user interface design prioritizes usability and accessibility, providing users with an intuitive and user-friendly experience. Through clear navigation and presentation of search results, users can quickly find and access relevant research documents, enhancing overall productivity and satisfaction.

V. CONCLUSION AND FUTURE

WORK

Looking ahead, there are several avenues for future work and research that can further enhance the capabilities and effectiveness of the document indexing and search functionality system:

Semantic Search and Natural Language Understanding: Explore the integration of advanced natural language processing (NLP) techniques to enable semantic search capabilities. By understanding the meaning and context of user queries, the system can provide more accurate and relevant search results, leading to a more intuitive and efficient user experience.

Personalized Recommendations: Investigate methods for incorporating user preferences, behavior, and feedback to provide personalized document recommendations. By leveraging machine learning algorithms, the system can tailor

search results and recommendations to individual user interests and preferences, enhancing user engagement and satisfaction.

Cross-Domain Integration: Extend the functionality of the system to support indexing and search across multiple domains and disciplines. By incorporating data from diverse sources and domains, the system can facilitate interdisciplinary research and exploration, enabling users to discover connections and insights across different fields of study.

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