

DEVELOPING A COMPREHENSIVE WEB-BASED SYSTEM FOR MANAGING DISSERTATION RECORDS AND GEOSPATIAL DATA FOR NDATA SCHOOL OF CLIMATE AND EARTH SCIENCES

Chimango Banda (GIS/003/20) & Onester Bester (GIS/001/20)

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MALAWI UNIVERSITY OF SCIENCE AND TECHNOLOGY

NDATA SCHOOL OF CLIMATE AND EARTH SCIENCES

EARTH SCIENCES DEPARTMENT

Date: 29 April, 2025.

DECLARATION

We Chimango Banda and Onester Bester confirm that the research project title "DEVELOPING A COMPREHENSIVE WEB-BASED SYSTEM FOR MANAGING DISSERTATION RECORDS AND GEOSPATIAL DATA FOR NDATA SCHOOL OF CLIMATE AND EARTH SCIENCES" is our work. We have never submitted it to any other institution for academic purposes. Any information we have used or mentioned from other sources has been properly credited with complete references.

Student name: Chimango Banda

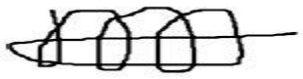
Signature: _____

Student name: Onester Bester

Signature: _____

Dissertation approved by:

Supervisor: Mr. Billy Kachingwe.

Signature: 

Assessor: _____

Signature: _____

Abstract

Transforming from manual based methods of managing documents in academic institutions to computerized digital methods in a very important technological improvement. Nagrama, N.D.C. (2021) explains that regardless the fact that document management systems are still standard especially in developing countries like Malawi, new technologies have allowed various institutions and organizations to switch from traditional manual record keeping document management systems to electronic document management systems. The aim of this project was to develop a comprehensive web-based system for managing dissertation records and geospatial data for Ndata school of climate and earth sciences dissertations. The aim of developing this web-based system was to address challenges associated with manually handling dissertations at Ndata school of climate and earth sciences. These challenges included limited accessibility to dissertation records by students, ineffective data retrieval and vulnerability of dissertations to damage. The implementation of this system allowed easy and fast access of dissertation records by students through the web using different devices (computers, mobile phones and tablets). The system also proved to be effective in providing a secure storage for the dissertation records thereby limiting the vulnerability of these dissertations to physical damage.

The developed system uses Google Firebase services (Backend as a service provided by Google) for authentication, cloud database storage, and file management. The system uses with Next JS, JavaScript, HTML, and CSS for the front-end interface. Firebase Authentication ensures that user access is securely managed, thereby allowing administrators to log in, upload, edit, and delete dissertation records. Firestore is the main database for storing metadata, while Firebase Storage is utilized for handling uploaded files such as GeoJSON and JPEG formats that represent study area maps. The platform is designed to be easy and user-friendly therefore it enables students to search dissertations based on title, author, school, supervisor, or study location, while administrators are provided with functionalities that allow them to manage dissertation records.

The project used prototyping as a system development methodology. Dennis et al explains that system prototyping involves performing analysis, design and implementation phases concurrently in order to quickly develop a simplified version of the proposed system and give it to the users for evaluation and feedback. This method was selected so as to gather user requirements through their feedback after viewing the system prototype. Results after implementation indicate that the platform meets its objective which is to develop a dissertation portal which will have a web-based interface for user interaction and a database for keeping the dissertation information. Administrators can manage dissertation records efficiently, and students can easily access dissertation remotely.

The developed web-based dissertation management system addresses challenges found in the traditional manual storage methods by enhancing easy accessibility, searchability and security of dissertation records.

Future efforts to improve the system performance will include enabling the upload of dissertation full-text documents (PDF files of dissertations), implementing backup functionality to avoid data losses, improving indexing for even faster searches under heavy system usage and allowing for upload of both GeoJSON and JPEG formats for single study area to allow users to appreciate the difference when viewing the two formats. These functions will be implemented with access to Google firestore paid services.

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Introduction

Background

As part of the academic program at Ndata School of Climate and Earth Sciences of the Malawi University of Science and Technology, students are required to conduct research project and submit dissertations. Vijayakumar, J.K (2007) points out that results of a research make a contribution to knowledge in various fields of study in which the research is being conducted. Dissertations show the ability of a student to formulate research questions, design methodologies, think critically and analyze results. As time goes the submitted dissertations become part of the university archive which serve as reference documents for future use by other students, scholars and researchers. Well written and organized dissertations may even be published in academic journals and presented at conferences. At Ndata school of climate and earth sciences, dissertations contain several sections including, abstract, field work data, methodology, results, critical geospatial information for study area visualization, conclusions and recommendations.

Like many other different organizations, Ndata School of Climate and Earth Sciences traditionally uses the manual record keeping system to manage dissertations for student's research project. Using the manual record keeping system to manage document is problematic and brings about several challenges such difficulties in data retrieval and risk of losing the data in the event of fire, water leakages, natural disasters and theft. In addition to the challenges, use of manual record keeping brings about limited access to past research and dissertations by students and researchers which could prove useful and aid in literature reviews, identifying research gaps present and help to prevent duplication of work that has already been done in previous research.

Nagrama, N.D.C. (2021) explains that regardless the fact that document management system, which uses paper is still standard especially in developing countries like Malawi, new have allowed various institutions and organizations to switch from traditional manual record keeping document management systems to electronic document management systems. Nagrama, N.D.C (2021) defines an electronic document

management system as a computerized system that enables the capture, organization, storage, retrieval and manipulation of electronic documents and records.

As web technologies, mapping and database management systems are advancing, the Ndata school of climate and earth sciences has the opportunity to transition from manual paper-based method of managing dissertation records to digital method of managing dissertation records. Adding to that, the use of geojson files and TIFF files can further enrich dissertation management by showcasing study locations using interactive maps, allowing students, researchers and lecturers to analyze research coverage across regions.

The aim of this project is that it seeks to address the inefficiencies, ineffectiveness and redundancies in dissertation management at Ndata school of climate and earth sciences by developing a modern, centralized, and user-friendly web-based system with integrated GIS functionality. The system will enhance digital archiving, enable metadata-based searching, and allow for the uploading and rendering of study area maps in GeoJSON and TIFF formats overlaid over the open street map canvas.

Problem Statement

The current method of storing dissertation records at the Ndata School of Climate and Earth Sciences is inefficient, difficult to maintain, and inaccessible to remote users. There is lack of centralized digital storage for dissertation information. Almost all dissertations at the Ndata School include geospatial component for displaying the study area map and the distribution of phenomena under study. The use of manual paper-based system of managing dissertations brings about the absence of GIS integration and this significantly hinders the ability of students to visualize and relate to the study area locations of different dissertation. Since the current system does not support interactive visualization of these elements, it becomes challenging to analyze the geographical distribution of research efforts or identify regional gaps in study coverage.

The manual system makes it difficult to locate and retrieve specific dissertations that students are interested in, as there is no centralized or searchable database. Researchers and students must navigate physical records located in the store room, which is time-consuming, tiresome and impractical work. Most of the times access to these dissertations

in the store room is also prohibited if supervisors are not present which is also a problem in case students need to go through these dissertation records in critical moments. The lack of a digital platform restricts access to dissertation records, particularly for remote users given that they are not on campus to physically access those dissertations at that particular time. This parameter limits and delays academic collaboration, knowledge sharing, and the ability of students and researchers to build upon existing work done by the previous groups.

In order to address these challenges, there is a need for a modern, centralized, and user-friendly web-based system that stores dissertation records in a well-structured and centralized database and can be accessed through a web-based interface. Such a system would prove to be very practical since not only would it enhance digital archiving and metadata-based searching but also allow for the dynamic visualization of geospatial data, thereby transforming how dissertations are stored, accessed, and utilized. By implementing this solution, the Ndata School can significantly improve the management, accessibility, and impact of its dissertation records on academic research.

Main and specific objectives

The main objective of this research project is to develop a dissertation portal which will have a web-based interface for user interaction and a database for keeping the dissertation information.

Specific Objectives:

- To develop a web-based platform with an interactive web interface using React Native, JavaScript and HTML that students, researchers and administrators will use to upload, search and access dissertation information.
- To design, develop and host a centralized database using Firebase to securely provide storage of all dissertation information and all related metadata for the school.

- To provide a search functionality based on keywords, course, supervisor, year, and location and enable uploading of dissertation study areas in GeoJSON and TIFF formats.
- To integrate the web-based platform with the database and upload dissertation information for testing.

Research Questions

This study will answer the following questions:

- What are the key functional requirements for a web-based dissertation portal to ensure usability for students, researchers, and administrators?
- How can a centralized database be optimally designed to store, retrieve, and manage dissertation records efficiently?
- What challenges arise when integrating a web-based platform with a backend database, and how can they be mitigated?
- What security measures should be implemented to protect dissertation data while ensuring authorized access for different user roles?
- How effective is the developed dissertation portal in improving accessibility and searchability compared to traditional manual record-keeping systems?

Significance of study

The first primary contribution of this study is that it will facilitate the easier access to past research work for students, faculty, and external researchers. Currently, manually stored dissertations limit accessibility, making it difficult for students at Ndata school of climate and earth sciences to identify research gaps, or build upon existing findings. By digitizing and centralizing dissertation records, this system will enable seamless retrieval of academic work, fostering a culture of knowledge sharing and academic continuity. Students and supervisors will benefit from streamlined access to past theses, reducing redundancy and encouraging more informed research approaches. The manual handling of dissertation records is time-consuming and labor-intensive, the system also requires physical storage maintenance and tedious retrieval processes. This study introduces a streamlined, automated system that significantly reduces administrative workload.

Features such as keyword search, metadata filtering, and role-based access will accelerate information retrieval.

Traditional paper-based storage systems are very vulnerable to physical damage, loss, or misplacement due to environmental risks such as fires, floods, or deterioration over time. A digital dissertation portal ensures secure storage, automated backups, and long-term preservation of academic work. By implementing a strong and well-structured database management and cloud-based hosting solution for files, this study mitigates the risks associated with manual record-keeping, ensuring that valuable research remains intact and retrievable for future use and study by students.

Another significance aspect of this project that will be helpful is the integration of Geographic Information Systems (GIS) into dissertation management. Many climate and earth science studies involve geospatial data, yet current systems lack interactive visualization tools. By allowing the upload of GeoJSON and TIFF files, this system will enable researchers to visualize study locations, analyze regional trends, and identify spatial research gaps of research projects carried previously by other students. This development will not only enhances dissertation presentation but also supports data-driven decision-making in environmental and climate research.

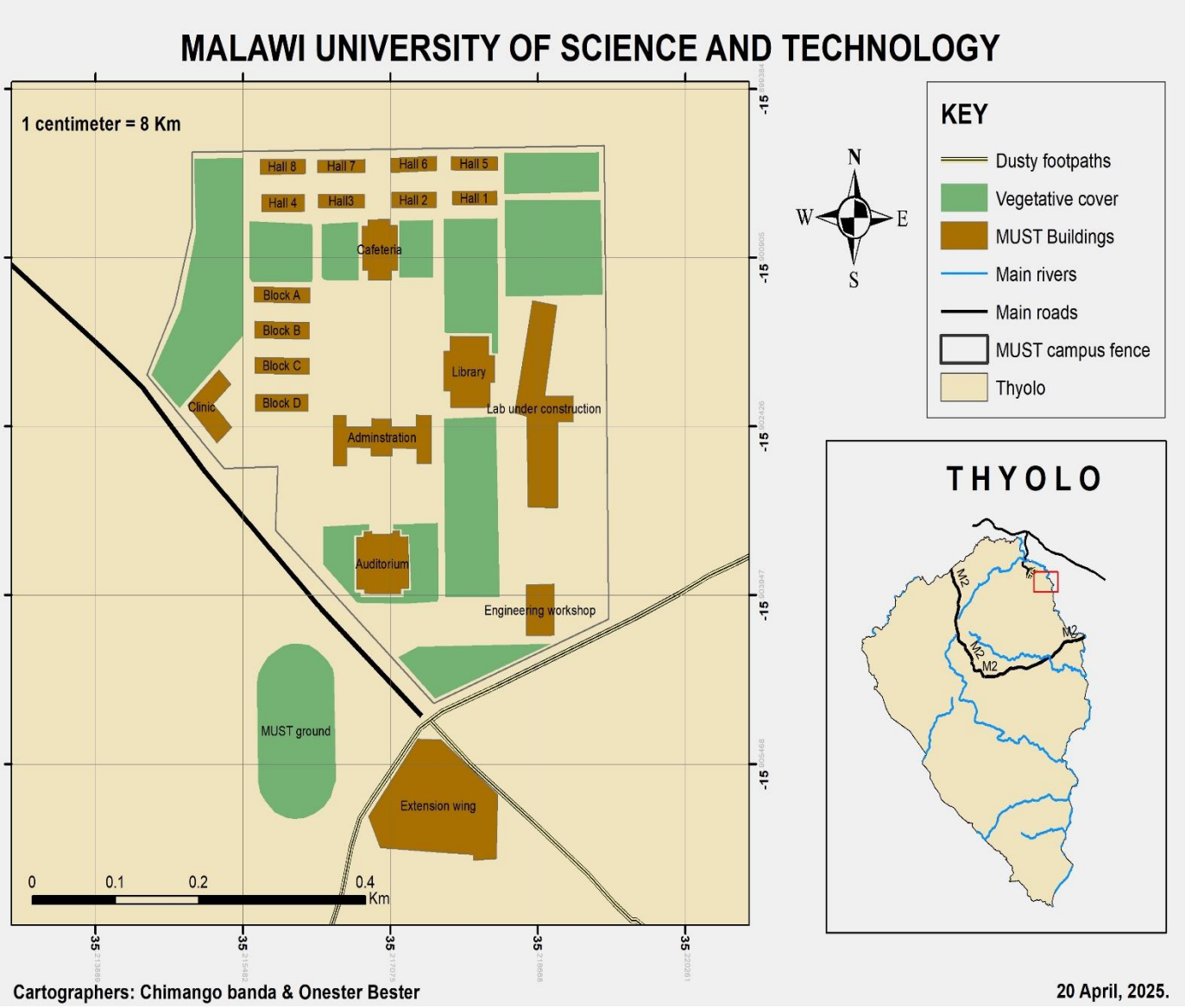


Figure 1. Study area map: Malawi University of Science and Technology

Literature review

In the contemporary academic perspective, the management of dissertation information has become increasingly critical, particularly in institutions including Malawi University of Science and Technology, MUST. The efficient organization of student dissertations not only enhances the accessibility of previous projects but also fosters an environment conducive to academic collaboration and knowledge sharing.

With the growth of digital technologies, traditional methods of managing academic records i.e dissertations are proving inadequate, highlighting the need for a robust web-based system. Such systems can offer transformative benefits, as evidenced by previous studies that indicate successful implementations of digital libraries in similar contexts have improved user engagement and resource accessibility (Majawa et al.). Additionally, adapting existing e-learning frameworks, particularly in institutions facing database management challenges, can help establish a more effective management system for dissertations (Garbers et al.). Therefore, developing a comprehensive web page system tailored to the needs of Malawi University of Science and Technology students is a timely and essential initiative that aligns with higher educational goals.

The establishment of this system that is incorporating dissertation database is crucial for advancing academic success, particularly for students of different schools at Malawi University of Science and Technology. A centralized database enables easy access to a wealth of scholarly resources, fostering a more efficient research process. As students navigate their dissertation work, they benefit from having a repository that offers previous studies, methodologies, and insights pertinent to their own research topics. This accessibility streamlines the literature review stage, allowing scholars to build upon existing knowledge and avoid redundancy.

Furthermore, as highlighted in studies on educational frameworks, integrating technology in higher education enhances teaching and learning processes, promoting a culture of quality and rigorous academic inquiry (Manda et al.). It will also provide a solution to storage issues by eliminating issues of physical space constraints and document deterioration. Database management systems handle concurrent access to the users and

ensure that their actions do not interfere with each other hence allowing multiple users to access dissertation records simultaneously. Most importantly, digitizing the records will safeguard them from potential loss due to disasters such as fire or water damage, ensuring long-term data preservation. By implementing a user-friendly web page system for managing this database, the institution can significantly empower students in their academic endeavors, leading to improved outcomes and higher standards of education (Garbers et al.).

Navigating the complex growth of dissertation management presents numerous challenges that must be addressed through a well-developed web-based system. One significant hurdle is the lack of a centralized repository for students' dissertations, resulting in fragmented access to essential resources and guidance.

The disparities in research focus, particularly in the educational sector in Malawi, further describes this issue, as identified in notable assessments that reveal pressing gaps in research priorities and action plans (Lungu et al.). Additionally, the administrative complexities surrounding dissertation logistics such as tracking progress, managing feedback, and coordinating with advisors to have access of the resource room can overwhelm students. A comprehensive web page system could streamline these processes by offering easy access to vital program information and organizational resources, much like the systemic approach outlined in MUST's mission and vision. Therefore, addressing these challenges is crucial to enhancing the dissertation experience for students at the Malawi University of Science and Technology.

The current systems in place at the Malawi University of Science and Technology (MUST) for managing dissertation data exhibit a number of limitations that hinder effective academic effective and accessibility progress. Existing databases often suffer from issues related to accessibility, which prevents students from efficiently retrieving vital information for their research. Additionally, the lack of integration with other existing school on campus resources creates a fragmented experience for users, necessitating cumbersome navigation through various platforms. Research conducted on similar systems indicates that such disjointed frameworks can lead to decreased functionality and

user satisfaction, underscoring the need for holistic improvement strategies (Abrams L et al.). Moreover, the absence of a user-friendly interface limits student engagement and the proactive management of their dissertation's, as detailed documentation is often not easily accessible. Addressing these shortcomings through the development of a comprehensive web page system can significantly enhance the management of dissertation databases, ultimately fostering a more conducive academic environment.

In designing a web page system for the dissertation database at Malawi University of Science and Technology, several critical features must be integrated to optimize usability and functionality for students and schools alike. Firstly, a user-friendly interface is essential to facilitate easy navigation and access to dissertation documents, thus promoting efficient research processes.

Additionally, the system should include robust search functionalities, allowing users to filter by keywords, author names, or study areas. Such features not only enhance the user experience but also improve the efficiency of information retrieval. Moreover, the incorporation of tools for uploading and managing documents will enable administrators to deposit finished project dissertations seamlessly, fostering a culture of academic contribution within the institution.

As highlighted in (Majawa et al.), effective digital libraries can significantly influence user engagement, suggesting that systematic management features are vital to the success of this proposed web page system. Furthermore, adopting a context-specific framework, as suggested by (Garbers et al.), will ensure that the system aligns with the educational policies and technological infrastructure present in Malawi, ultimately enhancing its effectiveness.

In developing an effective web page system for managing a dissertation database at the Malawi University of Science and Technology, several key functionalities are essential to enhance both user experience and database management. First, intuitive navigation and user-friendly interfaces are paramount, allowing students and school departments to effortlessly access and search for dissertation materials. Incorporating responsive design

ensures compatibility across various devices, thus accommodating diverse user preferences. Additionally, robust search functionalities, including advanced filters and keyword searches, significantly streamline the retrieval of specific documents. Quality management principles, as highlighted in the Total Quality Management, TQM model that emphasizes continuous improvement and customer satisfaction, suggests that understanding user needs enhances service delivery, aligning well with the integration of feedback mechanisms within the platform (Manda et al.). Furthermore, maintaining a secure and scalable database framework is crucial for preserving data integrity, which ultimately supports users in achieving their academic objectives while fostering a culture of research and innovation (Oluwadele et al.).

The development of a web page system for managing a dissertation database at the Malawi University of Science and Technology signifies a crucial advancement in academic resource accessibility and administrative efficiency. By addressing gaps in existing systems, this initiative not only streamlines the dissertation submission and review processes but also promotes collaborative learning among students and faculty. The integration of e-learning frameworks, as evidenced in related studies, highlights the importance of technological solutions in enhancing educational standards and ensuring that resources are effectively utilized to improve research outputs (Garbers et al.). Moreover, drawing from experiences with digital library implementations, it becomes evident that user engagement and accessibility remain paramount for success (Majawa et al.). Ultimately, creating a comprehensive dissertation management system will facilitate better academic practices, empowering students to successfully navigate their research endeavors while contributing to the institutions scholarly community.

The proposed web page system for managing a dissertation database at Malawi University of Science and Technology offers extensive benefits for all students from Ndata school, Malawi Institute of Technology MIT, Bingu school and culture and heritage and school of academic sciences while setting a promising direction for future enhancements in academic processes. By centralizing dissertation resources, the system will improve accessibility and streamline the research process, enabling students to find

relevant works swiftly, thus fostering a more conducive learning environment. Moreover, the digital platform can evolve into an invaluable tool for schools, allowing for better oversight and mentorship in student research activities, ultimately enhancing academic quality. As illustrated by the experiences of organizations like Jesuit Worldwide Learning, which utilizes similar technology for marginalized groups, tailored online education can mitigate barriers to entry, fostering inclusivity in academia (Badritdinova et al.). Furthermore, by developing comprehensive support structures linked to the system, as highlighted in the organization's operational documents and mission, the university can greatly transform educational engagement and success rates among students.

System analysis and design.

Methodology

By definition, a system design and analysis methodology is a formalized approach to implementing a system development life cycle (Dennis et al). For this particular system, Prototyping was selected as the system development methodology that will be used. Iterative development and prototyping are under rapid application development category of system development whereby Iterative development breaks the overall project into a series of versions that are developed sequentially (Dennis et al). Prototyping is an iterative process whereby a system developer builds a working model of a system to help stakeholders understand how the system features work to enhance feedback before the system is fully developed. This methodology of system development uses the model to gather feedback from users during the development in order to refine the user requirements. Dennis et al explains that system prototyping involves performing analysis, design and implementation phases concurrently in order to quickly develop a simplified version of the proposed system and give it to the users for evaluation and feedback. This methodology was selected for its alignment with the system's requirements and because of positive impact, whereby its benefits significantly outweigh its limitations. The first benefit of this system is that it has better user requirement gathering by promoting user involvement. Prototyping promotes active user participation whereby users interact with the model of the system and actively provide feedback which helps the users who struggle to communicate their needs from the system at the beginning of the project. The second benefit of prototyping is that functional problems, design problems, and usability problems can be detected very early in the system analysis and design process, which helps reduce the cost, time and resources needed to fix these problems later in the system development lifecycle. The third benefit of prototyping is that trust and confidence in the project as the users see a working model of the system which is helpful especially in environments where users are just being introduced to the new technology as in the case with dissertation management at Ndata school of climate and earth sciences. As for limitations, the first is that for complex systems it may be hard to develop a fully functioning prototype if some of the function

technicalities of the system are presented as being very simple. Another limitation is that if prototypes are discarded after receiving feedback from users then the resources invested in developing the prototype are wasted.

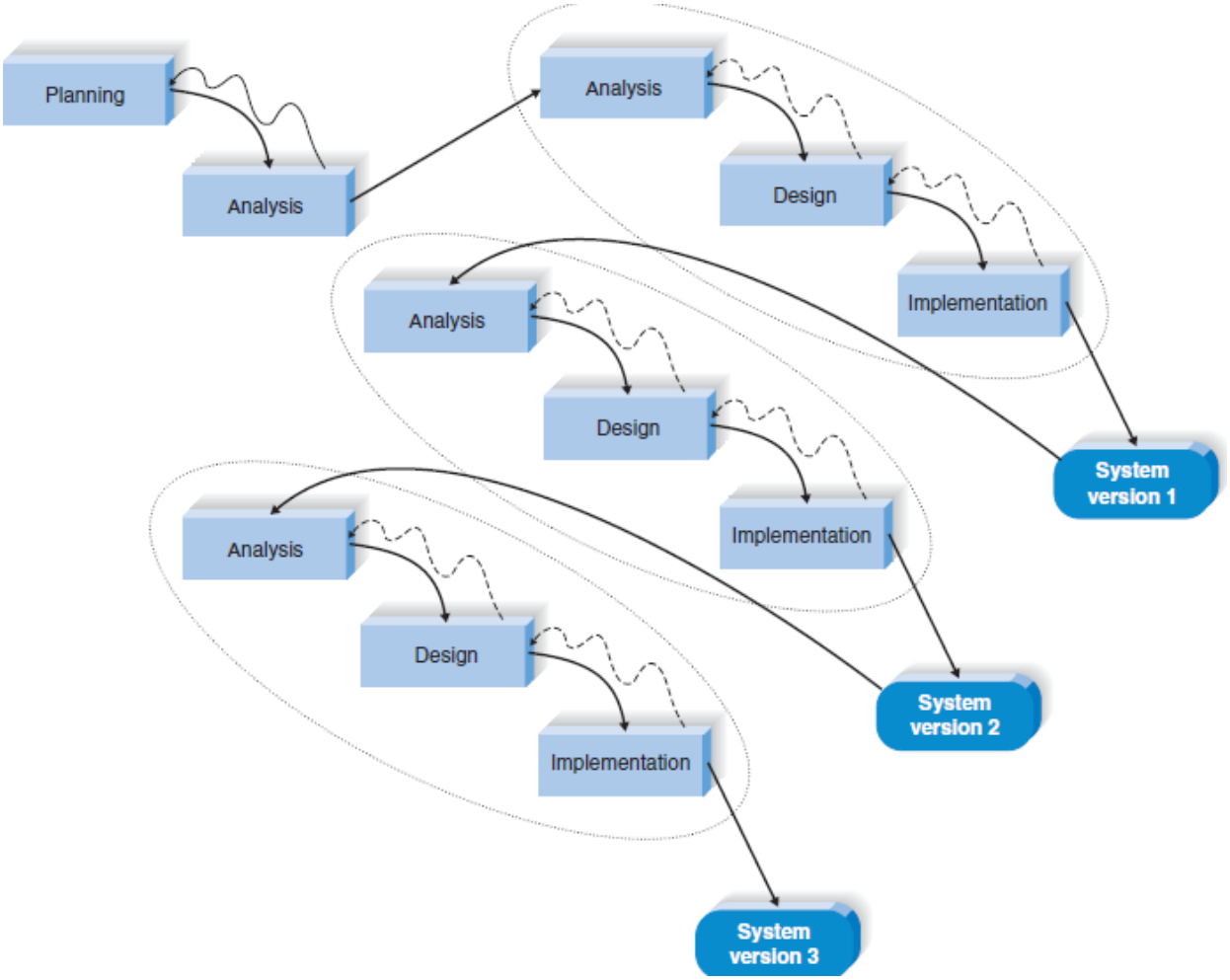


Figure 2. Iterative development methodology.

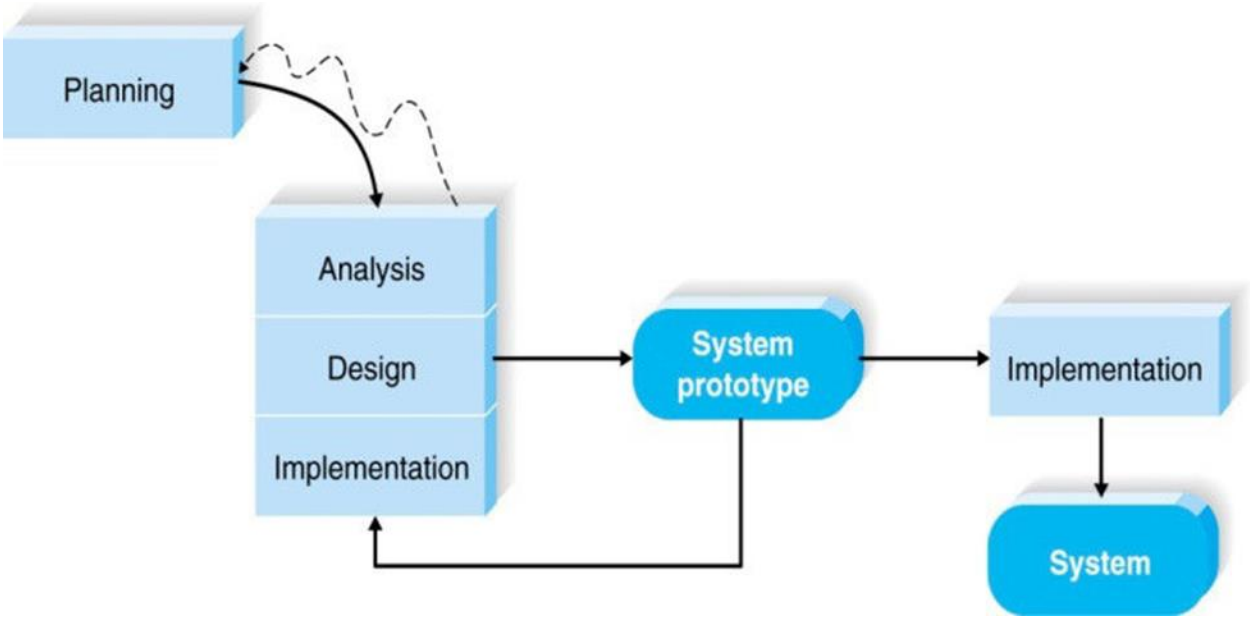


Figure 3. Prototyping Methodology of system development.

Preliminary analysis

The preliminary analysis (planning) phase is the fundamental process of understanding why an information system should be built and determining how the project team will go about building it (Dennis et. Al. 2012). Dennis also highlights that during project planning, the system's business value to the organization is Identified that is to say the efficiency, effectiveness and how the system will lower costs or increase revenues is evaluated. Feasibility study is used in the planning process to identify the value of the system to an organization. In this case, the business value and efficiency of the developed system to Ndata school of climate and earth sciences was evaluated.

Feasibility study

A feasibility study is a strategic process involving the evaluation and analysis of a proposed project or system so as to determine whether it is practical and achievable before significant time and resources are committed to its development. Girish (2020) recognizes feasibility study as an evaluation of a proposal to determine the difficulty in carrying out a task. Feasibility study is very important in System Analysis and Design, because it helps stakeholders decide whether the project is worth pursuing. The

following are the importance of a feasibility study in system analysis and design: it prevents wastage of resources, helps identify risks early during system development, and aids in planning the scope of the entire project.

Different authors identify several types of feasibility study. These include technical feasibility, operational feasibility, economic feasibility, schedule feasibility, cultural feasibility, marketing feasibility, legal feasibility and behavior feasibility. As an example, Jawahar (2022) identifies economic feasibility, technical feasibility and behavior feasibility as the main types of feasibility analysis.

For this project, which involves developing a web-based system for managing dissertations, three types of feasibility analysis were considered: technical feasibility, economic feasibility, and schedule feasibility.

These were selected because, in accordance with the requirements of academic research, a project should only be undertaken if it meets certain key conditions. First, the proposed system must be technically achievable, meaning it can function as intended and contribute to improving understanding or solving relevant academic or scientific problems (technical feasibility). Second, there must be sufficient economic resources to support its development (economic feasibility). Thirdly, the project should be realistically achievable within the allocated timeframe (schedule feasibility).

Technical feasibility

Under technical feasibility several points were analyzed for the system and validated as possible. The following were the issues that were analyzed:

- The current equipment and tools that are available can be utilized in development of the system (computers, programming languages (HTML, CSS and JavaScript) and code editors (VS code).
- The system that was developed can be supported by existing technology (users can interact with the system using all web browsers (Google chrome, Mozilla, Firefox, Safari etc.) and existing backend

cloud services (Firebase) can host databases as well as authenticate access of database information).

- The developed system can be expanded and upgraded to provide more functionality (with paid services which enable indexing functionality in firebase, the system can be upgraded provide more functions and even keep softcopy dissertation files in addition to the dissertation data).
- The developed system has excellent security for dissertation data since Firestore authentication was used to restrict access, login and editing functions to the data.
- System accuracy was ensured in presenting dissertation data to users since the system only uploads dissertation data to the system database only when all requirement fields on the submission form of adding dissertations are filled.

Economic feasibility

A cost-benefit analysis was used to evaluate the economic effectiveness of this particular system. A cost-benefit analysis is a procedure is used to determine the benefits and savings that are expected from ancandidate system and compare them with costs (Jawahar, 2022).

Costs identified in the system

- System design tools (Wondershare edraw and Figma)
- Firebase services
- Internet bundle costs
- Documentation and training materials (printing dissertation for the project, user manual and help guide).

Benefits of the system that were identified

- Reduced administrative work in managing manual dissertation records.

- Faster and remote access to dissertation information (For those who are not physically on campus, saving transportation costs).
- Reduced printing.
- Reduced archiving costs.
- Institutional reputation that can attract investors to invest money for the expansion of the system (intangible cost).

COST	VALUE (KWACHA)
System design tools	MK90,000.00
Firebase services	MK200,000.00
Internet bundle costs	MK40,000.00
Documentation of materials	MK80,000.00
Total	**MK410,000.00**

Figure 4. Estimated costs values

BENEFIT	VALUE (KWACHA)
Reduced administrative work	MK300,000.00
Faster remote access to dissertation information	MK100,000.00
Reduced printing costs	MK80,000.00
Reduced archiving costs	MK100,000.00
Investors	MK1,000,000.00
Total	**MK1,480,000.00**

Figure 5. Estimated benefit values

Total benefit	MK1,480,000.00
Total cost	MK410,000.00
Net benefit (5 months)	**MK1,070,000.00**

Figure 6. Estimated cost benefit comparison

The project proved to be economically viable because the total estimated benefits exceeded the total estimated costs by **MK1,070,000.00** and it has improved efficiency in accessing dissertation information than the manual system of managing dissertations.

Schedule feasibility

Schedule feasibility is the process of determining whether a project can be completed within a specific time frame, using the available resources (money and tools). After identifying the steps of development that will be required to conduct the project, A work breakdown structure for the project was developed.

A work breakdown structure (WBS) organizes project work into manageable tasks which are necessary to carry out and complete the project. A WBS is like a to-do list for the entire project, organized in a structured, hierarchical way from high-level deliverables to detailed tasks.

After developing the work break down structure, it was compared with available time to determine the schedule feasibility.

Task #	Task name	Plan start	Plan finish
1	Developing a comprehensive web-based system for managing dissertations	27 Jan 2025	28 Apr 2025

1.1	Reviewing literature & identifying user requirements	27 Jan 2025	14 Feb 2025
1.2	System analysis, design and development	15 Feb 2025	11 Apr 2025
1.2.1	Feasibility study	15 Feb 2025	22 Feb 2025
1.2.2	Data flow diagrams (DFD) and Entity relationship diagrams (ERD)	23 Feb 2025	02 Mar 2025
1.2.3	System development	03 Mar 2025	11 Apr 2025
1.2.3.1	User interface	03 Mar 2025	!6 Mar 2025
1.2.3.2	Database development and populating data	17 Mar	10 Apr 2025
1.2.3.3	Presenting first prototype	11 Apr 2025	12 Apr 2025
1.3	System maintenance and documentation	13Apr 2025	28 Apr 2025
1.3.1	System maintenance	13 Apr 2025	16 Apr 2025
1.3.2	Documentation	17 Apr 2025	28 Apr 2025

Figure 7. Work breakdown structure of the project

The system activities took approximately 4 months to the point of completion. The coincides with the 4 to 5-month period of a semester in which the development of the system was supposed to be done. Therefore, it was concluded that the system was schedule feasible.

Having evaluated the system to be technically, schedule-wise, and economically feasible, it was concluded that the project is viable to proceed to the design phase, including system architecture, use cases, and entity relationship diagrams.

System Analysis

The analysis phase answers the questions of who will use the system, what the system will do, and where and when it will be used. During this phase, the project team gathers user requirement, investigates any current systems, and identifies improvement (system requirements) (Dennis et. Al. 2012). In system development, user requirements are gathered first and then translated into system requirements that developers use to build the system.

User Requirements

User requirements specify what end-users expect from the system in terms of features and usability. They are important because they help in developing the objectives and technical specifications of a system by capturing user needs and expectations. These requirements reflect what the end users want to achieve and describe the specific actions they should be able to perform using the system.

For this particular system, the following were some of the user requirements:

- The system should allow students to upload their dissertation records and their respective study area maps in both GeoJSON and JPEG formats.
- The system should allow students to view dissertation information and visualize its corresponding study area maps in both GeoJSON and JPEG formats in order to appreciate the difference.
- The system should allow students to edit their dissertation information in case of some changes.
- The system should be accessible through web browsers on both desktop and mobile devices.

- The system should allow and support users in exporting data and generate reports in form of CSV and PDF formats.
- The system should allow users of the system to download student dissertation files.

System requirements

After gathering the user requirements, these requirements were then translated into system requirements (technical needs a system must meet to work properly) that later served as a template for developing the system. The system requirements that were identified were of two types. The first was functional requirements that highlight what the system should do. The second type was the non-functional requirements that highlighted how the system should perform. Below is a breakdown of the system requirements for this project with respect to their specific type.

Functional requirements

I. The system has user (Administrator) access abilities through:

   a. User registration

   b. Secure login

II. The web-based user interface (Administrator page) has a submission form for:

   a. Title

   b. Abstract

   c. Student name

   d. Program of study

   e. Supervisor

   f. Study area

      - GeoJSON file

      - JPEG/PNG file

III. Search and retrieval

a. The system was able to Search filter by:

- Title
- Student name
- Program of study
- Study area

IV. GIS Visualization

a. The system was able to display JPEG file or GeoJSON file of study area map using leaflet library.

b. The system has a clickable study area to display metadata (name of study area, title, author)

Nonfunctional requirement

I. Scalability

a. Should be able to handle growing numbers of dissertation records.

II. Usability

a. Should have a user friendly with easy to use and interpret dashboard and forms

III. Portability and Cross-platform

a. Should be accessible from all devices (PC, tablets and phones)

Use case diagram

This use case diagram is simply a visual tool used to show how the users (actors) of the system interact with the developed web-based system to achieve specific goals, or also known as use cases.

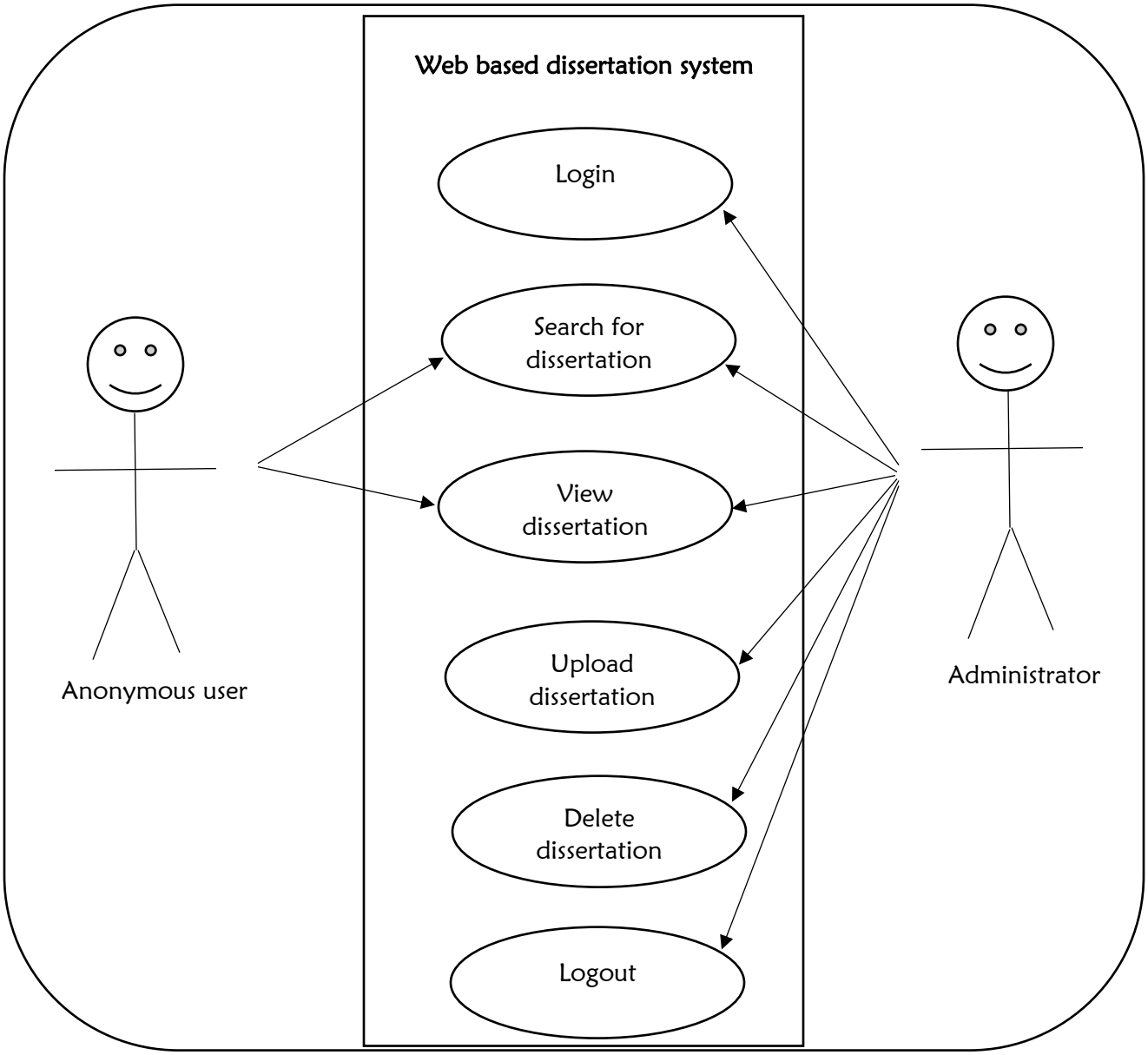


Figure 8. Use case diagram

System Design

Data flow diagram

A data flow diagram is a model that shows the flow of information in a system. It illustrates how data enters, gets processed, and exits the system without showing the actual physical implementation of the system. The data flow diagram that was developed for the system helped visualize and understand the whole journey of the data that was used in the system.

Amongst the two types of data flow diagrams (Yourdon & Coad and Gane & Sarson), Yourdon & Coad was selected. This is so because Yourdon & Coad data flow diagrams are excellent at representing data flow in system analysis and design.

A high-level diagram, also known as a level 0 Yourdon & Coad diagram was used because it is easier for a stakeholder with minimal or no programming knowledge to understand the system's data flow.

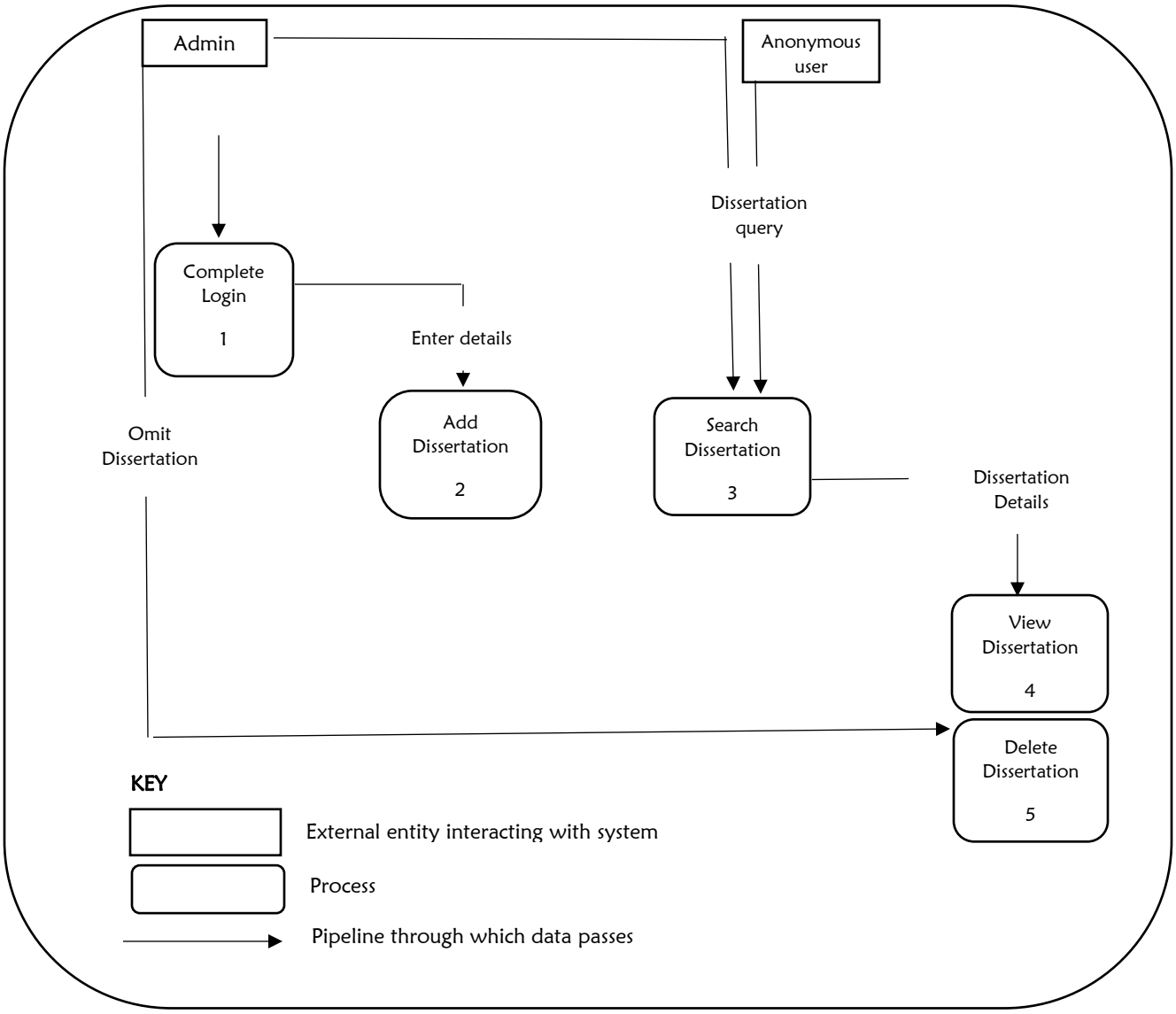


Figure 9. Level 0 contextual data flow diagram

System Architecture

The system architecture defines how different components of the system interact to meet the functional and non-functional requirements of the Ndata School of Climate and Earth Sciences' dissertation portal. It follows a client-server model built on cloud-based technologies with web front-end and Firebase backend services.

The system is divided into three key layers, each responsible for specific functionalities:

a) Presentation Layer (Client-Side Interface)

- Built using React Native, HTML, CSS, and JavaScript.
- Provides user interfaces for login, dissertation upload, search, and map visualization.
- Accessible via any modern web browser on desktop or mobile devices.

b) Application Logic Layer

- Handles interaction between user input and data management.
- Implements business logic such as:
    - User role management (admin, student, supervisor).
    - Metadata validation before upload.
    - Dynamic rendering of search results and maps.

c) Data Management Layer (Backend)

- Hosted on Firebase, this layer comprises:
    - Firestore Database: Stores dissertation metadata (title, author, course, year, supervisor, etc.).
    - Firebase Authentication: Manages secure user login and access control.
    - Firebase Storage: Stores uploaded dissertation data, and maps (GeoJSON, JPEG).

d) GIS Layer (Map Visualization)

- Utilizes Leaflet.js to display interactive maps.
- Integrates with uploaded GeoJSON and JPEG files to visualize spatial data related to study areas.
- Enables users to click map features to view associated dissertation data.

How the system works

1. User Access: A user (student or admin) logs into the system via Firebase Auth.
2. Upload/Interaction:
    - Students upload dissertations, metadata, and optional GeoJSON/JPEG files.
    - Admins approve, manage, or delete records.
3. Data Storage:
    - Metadata is stored in Firestore.
    - Files are uploaded to Firebase Storage.
4. Search and Retrieval:
    - Users query the database via the web UI.
    - Results are displayed in a searchable table with interactive map support.
5. Map Visualization:
    - GeoJSON and JPEG files are rendered onto a map canvas.
    - Clicking map features displays relevant metadata.

Deployment Architecture

- Hosting: Firebase Hosting for serving frontend.
- Data Services: Firebase for database, file storage, and authentication.
- Backup & Recovery: Scheduled backups and version control through Firebase console.

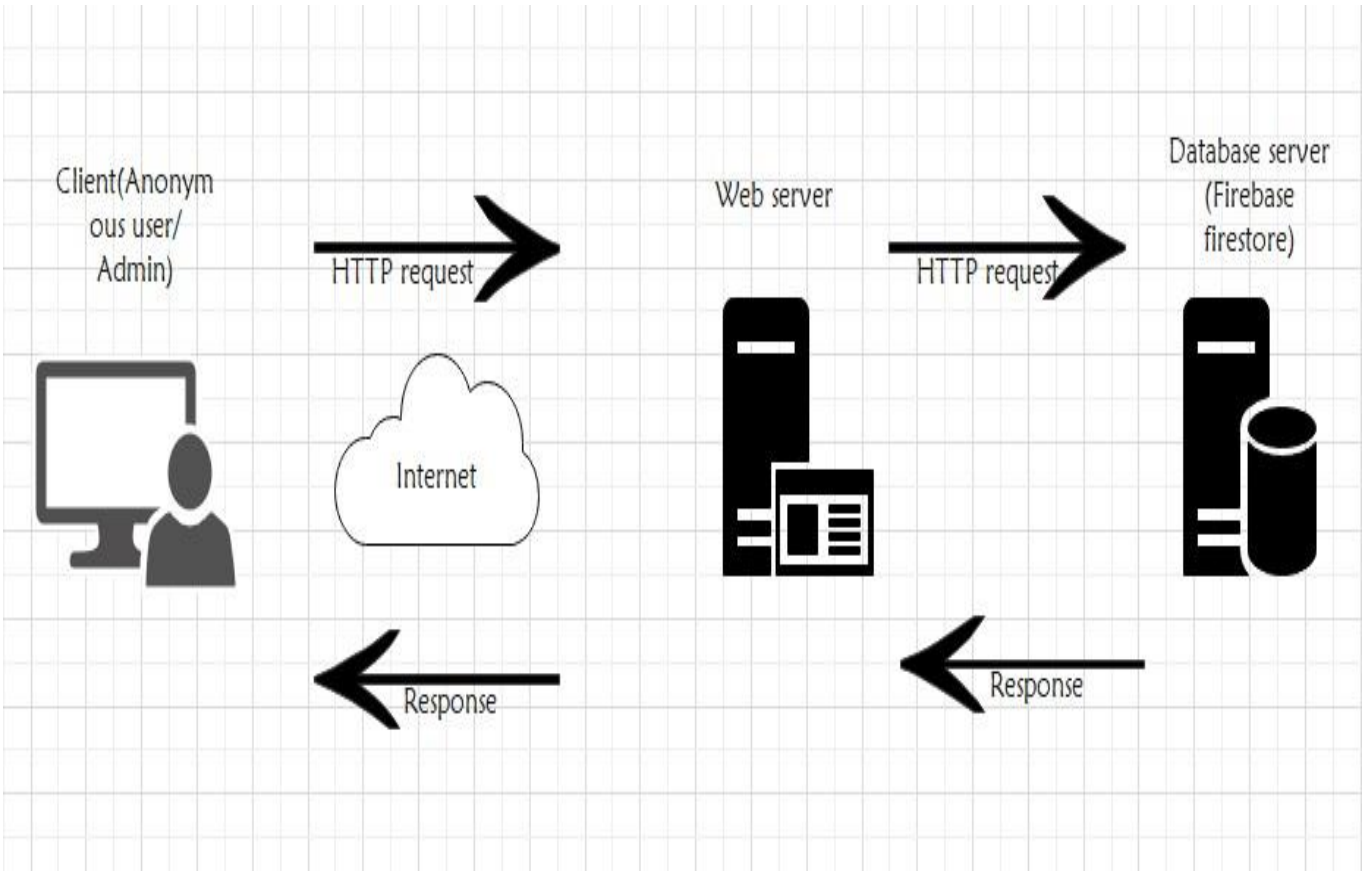


Figure 10. System architecture

Database design

Data models, data schemas and entity relationship diagrams are used in database design. A data model is a collection of concepts that can be used to describe the structure of a database. A data schema is the description of the database itself. A data Schema for this systems' database was displayed by means of a graphical notation known as an entity relationship diagram.

Below is the entity relationship diagram for the system' database which illustrates the entities, attributes and relationships existing in the database.

An Entity is a real-world object whose data is being stored in a database. An attribute is a characteristic or a piece of information that is used to describe the nature of a database entity.

Relationships exist amongst database entities.

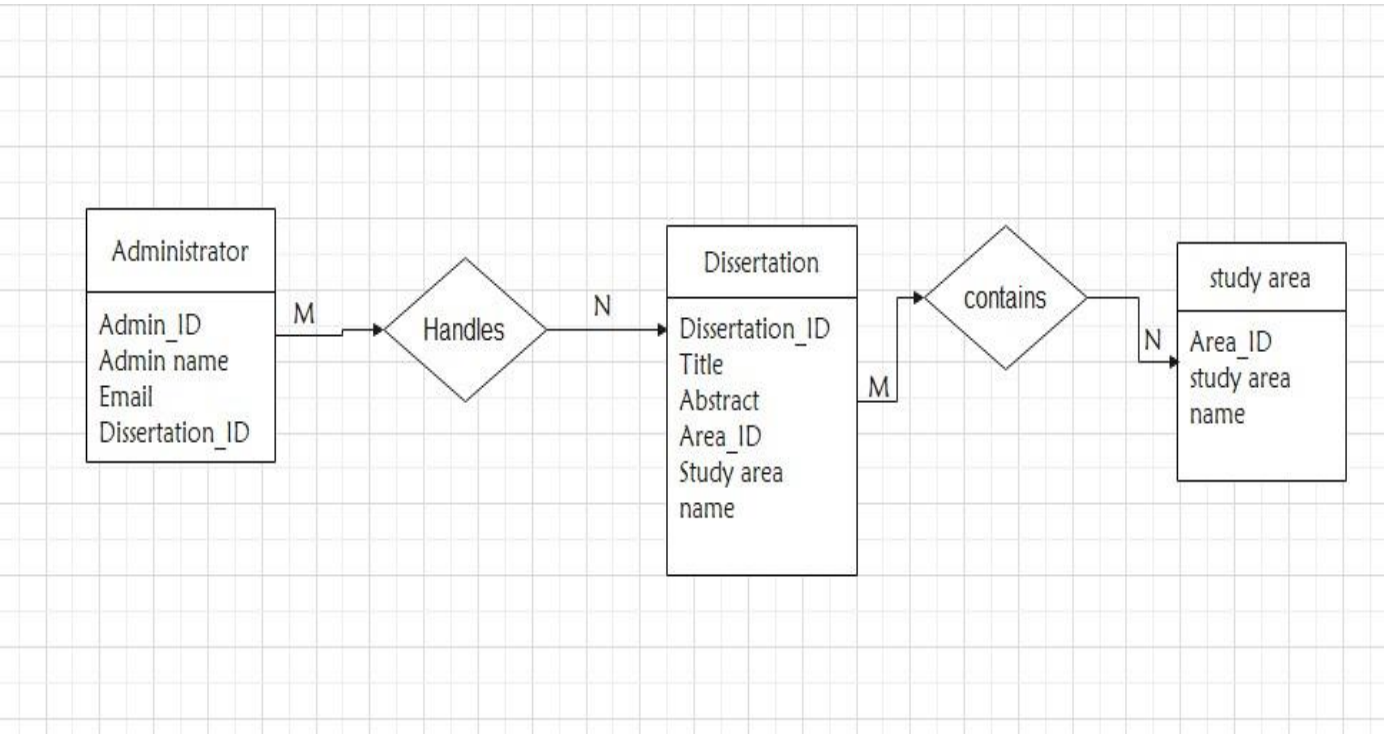


Figure 11. ER Diagram for system' database.

Implementation

Several tools, languages, framework, libraries and software were used to implemented the designed system.

The following are tools that were used:

- Visual studio code
- Next JS
- Vercel
- Google Firebase
- HTML
- CSS
- JavaScript
- Leaflet

Firebase initial configuration

The first code in appendix 1 is performed the function of for integrating Firebase services into the web system (web application). This code configured Firebase and made essential services (authentication, cloud database and storage) available throughout the system.

The code begins with the import of specific Firebase SDK modules: initializeApp, getAuth, getStorage, and getFirestore. These modules are responsible for initializing the Firebase application and accessing the firebase essential services: Authentication, Cloud Firestore, and Cloud Storage.

The next significant block in the code is the firebaseConfig object. This configuration object contains important identifiers that uniquely connects this frontend with a specific project hosted in the Google Cloud. The fields include:

- apiKey: A public key that allows access to Firebase services.
- authDomain: The domain under which the Firebase Authentication system operates.

- projectId: A unique identifier for the Firebase project.
- storageBucket: Specifies where files will be stored in Firebase Storage.

After setting up the configuration, the application is initialized using initializeApp(firebaseConfig).

Finally, the code exports the initialized services (auth, db, and storage) for use in the application. This allows any part of the application to easily access Firebase features by importing the corresponding service.

This code serves as the entry point for connecting a frontend of our system with Firebase. It establishes the backend connection for user authentication, data storage, and file handling.

Functions present in the web-based system for managing dissertations

The second code in appendix 2 is a code of functions used to manage users and dissertations in a Firebase-based database for managing dissertation information. It uses Firebase Authentication, Firestore (the actual document database), and Firebase Storage to handle everything from user login to dissertation uploads.

The first section of the code imports critical modules: authentication (signInWithEmailAndPassword, createUserWithEmailAndPassword), Firestore database methods (collection, doc, getDocs, getDoc, etc.), and storage operations (uploadBytesResumable, ref, getDownloadURL).

Next, a utility function called customSplit is defined. This function is designed to help with search functionality. It takes a string and generates various partial strings by slicing it word by word. This helps in indexing dissertation title searches more effectively, allowing for easy search functioning based on partial matches with the searched key word.

The code is setting up the guidelines about what kind of data is allowed in the system to ensure consistency and avoid redundancy.

- User holds metadata such as name, email, role, and avatar URL.

- Dissertation contains all the data related to a dissertation, including author, abstract, and study area.
- Abstract and Study Area are substructures within Dissertation.
- UserLoginCredentials and CommitResult define the structure for login inputs and operation results respectively.

The system provides functions to handle user-related operations. The login function allows system administrator to sign in using email and password, then retrieves and returns user data stored in Firestore. The register function handles user registration, while also storing user details.

The code also includes a very important function called checkIfMemberExists function that checks whether a user exists in the system before registration or login, improving validation and preventing duplicates.

For handling dissertation data, the code provides 4 operations. These operations are of creating, reading, updating and deleting data:

- submitDisertation saves a dissertation in both a general collection and a user-specific collection.
- deleteDissertation removes it from both locations using a batch delete.
- getAllDAta retrieves all dissertations from the database.
- searchDissertation enables keyword-based searches by querying against indexed "queries" fields, which are expected to be derived from customSplit.

The uploadFile function manages file uploads to Firebase Storage. The file is stored under a structured path (/images/{email}/{title}/{fileName}), ensuring logical organization of user data.

The whole code in appendix 2 performs combination of database interactions, authentication, file uploading, and search capability.

Results and discussions

The development of the web-based dissertation management system for the Ndata School of Climate and Earth Sciences has yielded significant results in terms of functionality, usability, and access to dissertation information. The system has successfully implemented core features for advanced search capabilities for dissertations, viewing dissertation records (title, author, supervisor, abstract and study area), administrator login, uploading dissertation, updating dissertation details and deleting dissertation.

In terms of Administrator login, the integration of Firebase Authentication allowed for a secure login process of administrators. Administrators can quickly log in to perform several functions (uploading, updating and deleting dissertation entries). The authentication process has proven to be efficient, with no major issues related to login or user session management, thus enhancing the administrator experience.

The dissertation submission features were successfully implemented, allowing administrator to upload dissertation information along with associated files (e.g., map images, and GeoJSON files). Through Firebase Storage, files were uploaded without interrupting the user experience, and dissertation data was securely stored in Firestore, ensuring that academic records are well-organized and easily accessible.

The search functionality has enabled students and administrators to locate dissertations quickly, using keywords and study areas. The real-time query results feature of Firestore was very effective in returning relevant data based on the searched keyword, making it easier for users to find research materials. The system's ability to handle multiple keywords has enhanced its flexibility, allowing users to search using different data types such as dissertation titles, abstracts, and author.

While the system has been successful in addressing the key objectives of managing dissertations, one area that requires further improvement is the file upload performance when dealing with larger files. Although the system handles small file uploads effectively in most scenarios (map images and GeoJSON files), it can not manage to upload larger files due to limited functionality of the free firebase service. It is for the same reason as to

why there was no option of uploading or downloading the actual document of a particular dissertation in the system. This could be addressed by purchasing the paid service of the Google firebase to enable storage of larger files and enhance complex indexing which could improve search and retrieval functions when the system is under heavy use.

Homepage

Using the following URL (universal resource locator): https://dissertationportal.vercel.app/ , the user is taken to the homepage of the dissertation portal where students can search for dissertation titles on the search bar and administrators can login into the system. After inputting the key word, every dissertation related to that search word will pop up and users can click on the view details option of the dissertation in which they are interested in. The image below shows the homepage of the system.

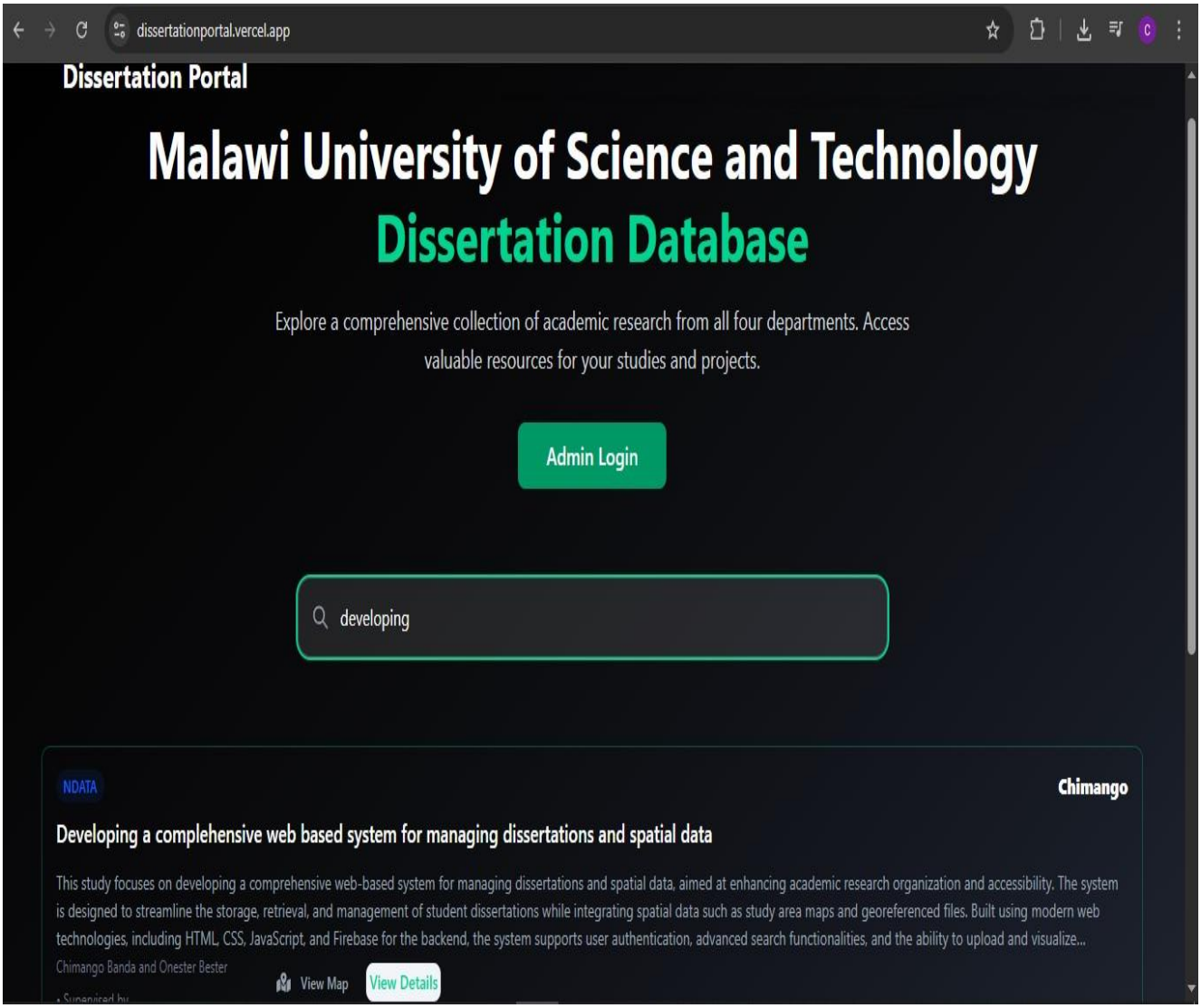


Figure 12. Homepage

Dissertation details page

After the user has selected the view details option for a particular dissertation, the dissertation details page will pop up where the user can now view the title, author, abstract and study area map of that particular dissertation. The dissertation details page can also be accessed using the following URL: https://dissertationportal.vercel.app/dissertation/details .

Below in a figure showing the dissertation details page.

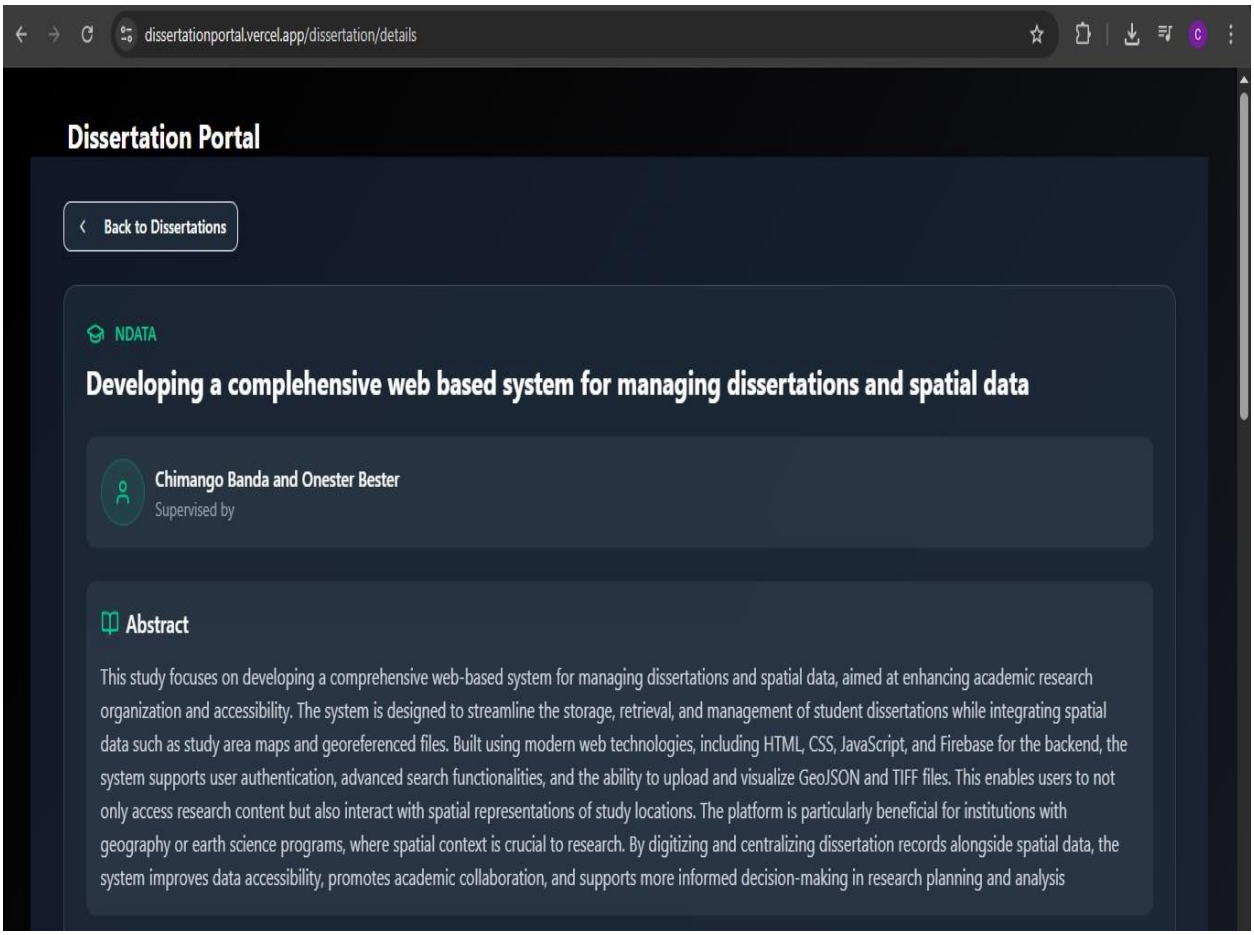


Figure 13. Title, author and abstract of a dissertation

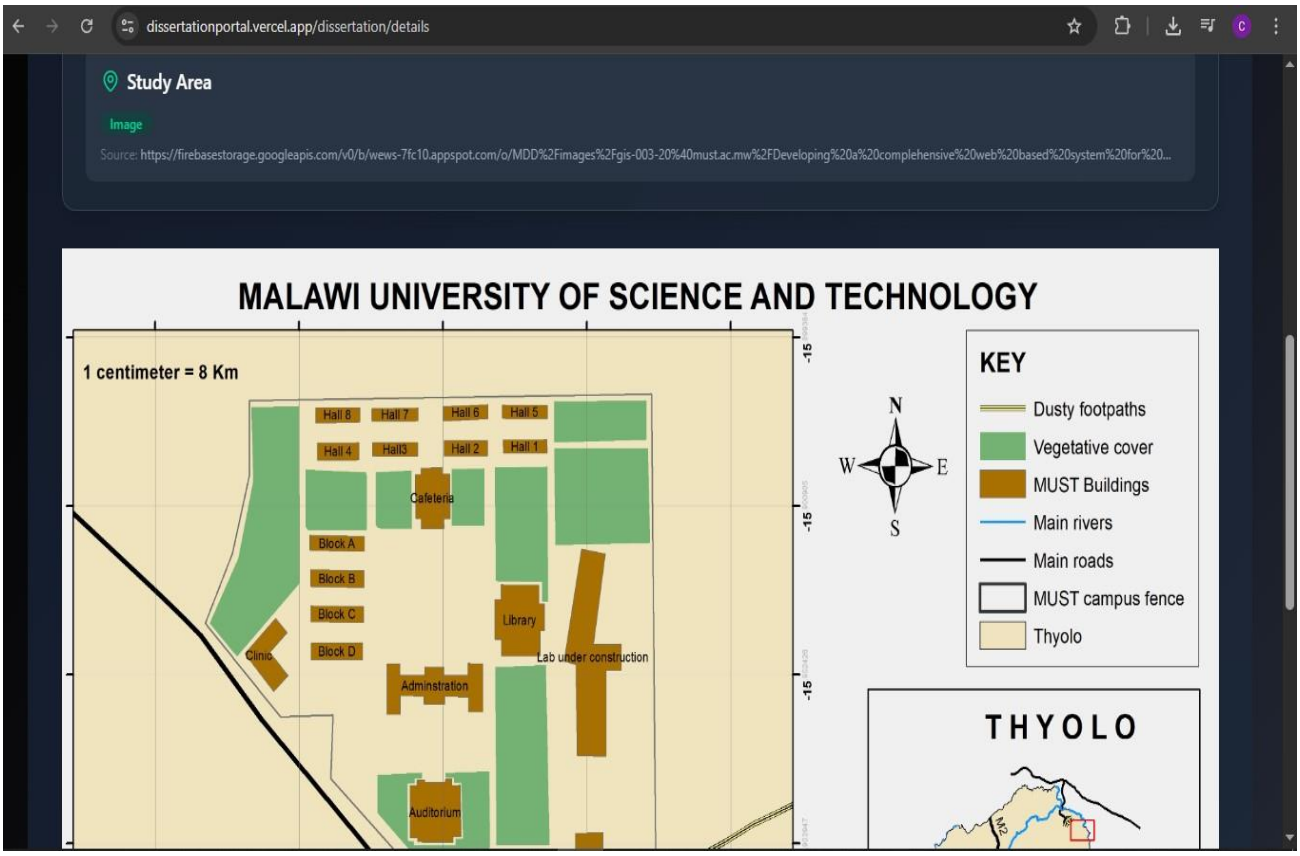


Figure 14. Study area map of a dissertation in JPEG format.

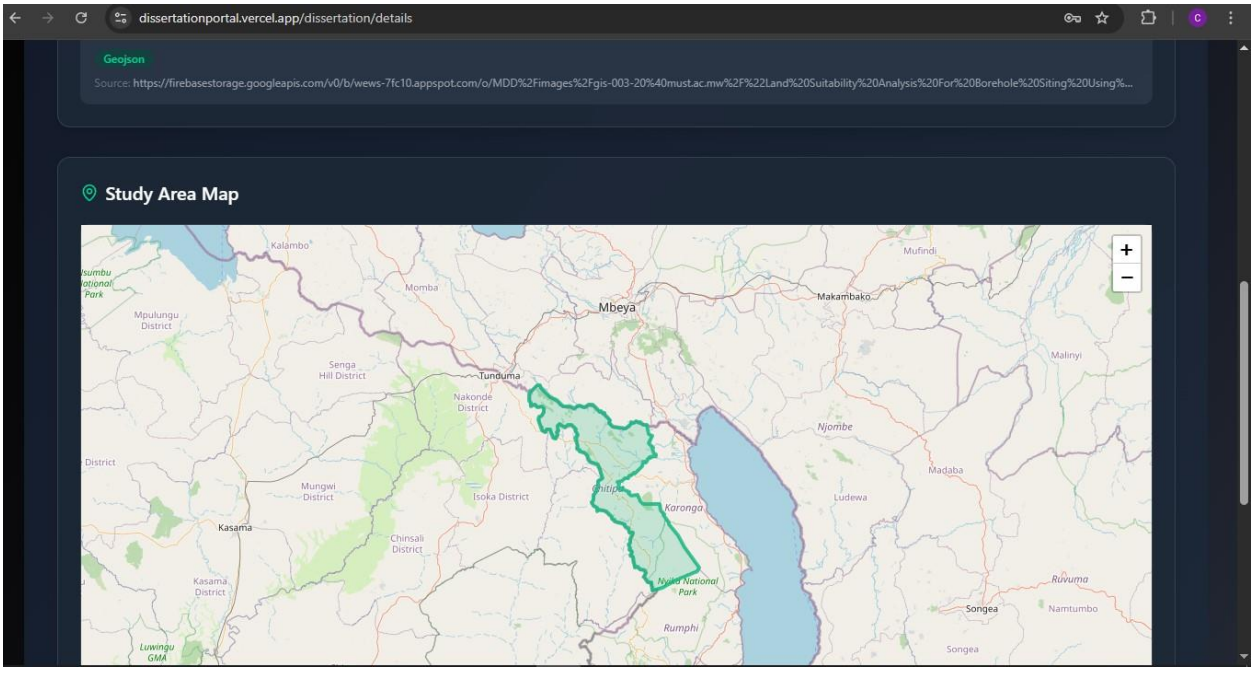


Figure 15. Study area map of another dissertation in GeoJSON format.

Sign in page

The sign in page enables an administrator (that has been given access rights in the backend) to fill in the details and login into the system. These details include admin email and password.

The admin login page can be accessed through the link: https://dissertationportal.vercel.app/auth/login .

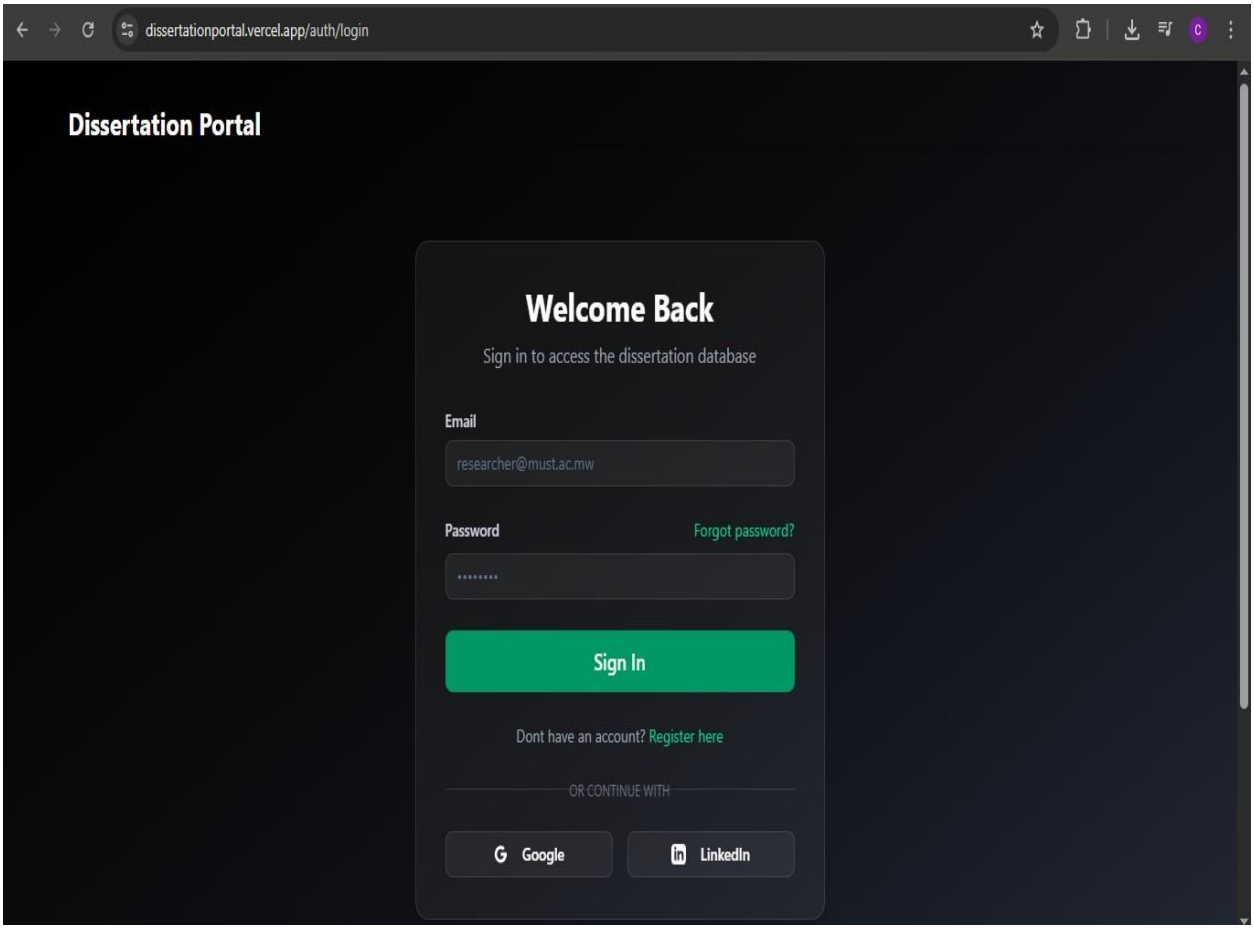


Figure 16. Sign in page

Creating dissertation post page

An admininstrator can search for dissertation on the search bar as a normal and the admininstrator can also add a dissertation entry into the system. This page requires that an administrator should enter the following details. The particular school (department) the author of that particular dissertation belongs to, student name(author), dissertation title, abstract of the dissertation and the study area map of that particular research in GeoJSON format or as a JPEG image format.

Although the admin can only choose one of the two formats for the study area map, future plans are to enable uploading of both files so that the user viewing the map can appreciate the difference between a GeoJSON file (allows viewing of file metadata or attributes) and JPEG file which allows appreciating the cartographic still of the author in representing features using different symbols and styles to display the study area.

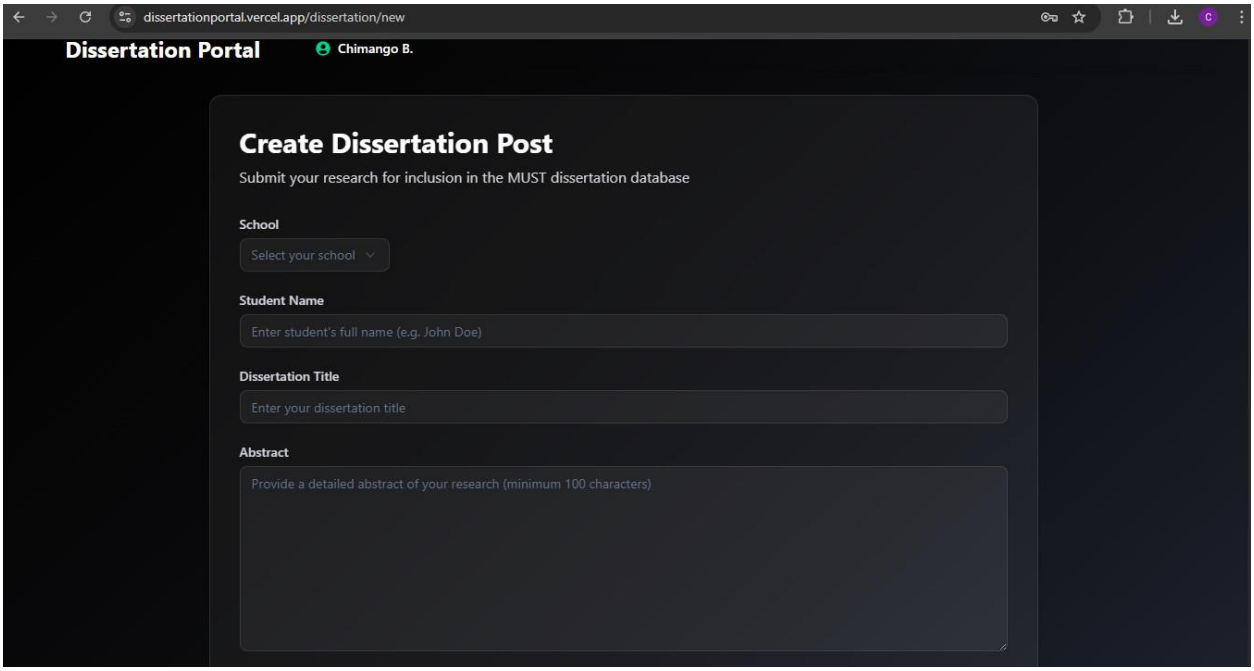


Figure 17. Filling dissertation entry form with school, author, title and abstract details.

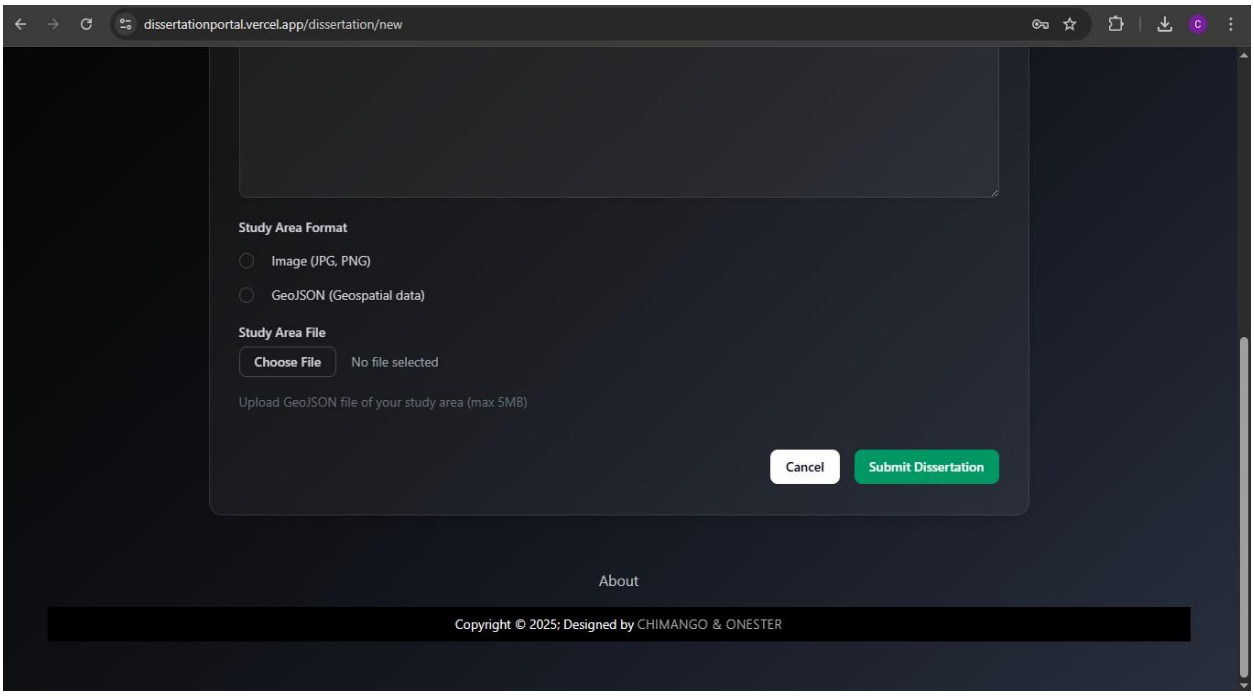


Figure 18. Selecting study area format and choosing study area file from computer storage to upload.

Although the deletion functionality, has been integrated effectively, administrators must be cautious when managing critical data. The system currently does not provide an undo feature for deleted or updated dissertations, which could potentially lead to the loss of important academic work. Implementing these features in the future would improve data integrity and prevent accidental data loss.

The system has met the expectations set out in the project objectives, delivering a functional, user-friendly, and efficient platform for dissertation management. The integration of Firebase, Vercel, and Next JS tools has made it responsive. The system will contribute to a more streamlined and organized way of managing, accessing and using academic work for reference.

Conclusion

The development of this web-paged system at Malawi University of Science and Technology represents a significant step forward in managing dissertation data comprehensively and efficiently. The current method of storing dissertation records at Ndata School of Climate and Earth Sciences is inefficient, difficult to maintain, and inaccessible to remote users. This raised an issue of lacking a centralized digital storage for dissertation information. This system also integrates geospatial component for displaying the study area map in two formats and the distribution of phenomena under study. The tradition and current system does not support interactive visualization of these elements, it becomes challenging to analyze the geographical distribution of research efforts or identify regional gaps in study coverage. Researchers and students must navigate physical records located in the store room, which is time-consuming, tiresome and impractical work. Most of the times access to these dissertations in the store room is also prohibited if supervisors are not present which is also a problem in case students need to go through these dissertation records in critical moments. These parameters limit and delays academic collaboration, knowledge sharing, and the ability of students and researchers to build upon existing work done by the previous groups. By addressing these limitations of traditional file storage, the university can enhance accessibility, improve data quality, and support research collaboration effectively.

The successful implementation of this system has the potential to enhance the academic landscape at MUST and contribute positively to the research community at large. The significance of this study is that it will facilitate the easier access to past research work for students, faculty, and external researchers. This system will enable seamless retrieval of academic work, fostering a culture of knowledge sharing and academic continuity. Users will benefit from streamlined access to past thesis, reducing redundancy and encouraging more informed research approaches. This study introduces a streamlined, automated system that significantly reduces administrative workload. Features such as keyword search, metadata filtering, and role-based access will accelerate information retrieval. A digital dissertation portal ensures secure storage, automated backups, and long-term preservation of academic work. By implementing a strong and well-structured database

management and cloud-based hosting solution for files, this study mitigates the risks associated with manual record-keeping, ensuring that valuable research remains intact and retrievable for future use and study by students i.e firestore. This development will not only enhance dissertation presentations but also supports data-driven decision-making in environmental and climate research.

Recommendations

Based on the challenges currently faced by the Malawi University of Science and Technology (MUST) in managing, sharing, and ensuring the quality of dissertation data, it is recommended that the university has to undergo transition from the traditional paper-based storage system to a more modern and efficient web-based database management system. A web-paged system would offer significant advantages in organizing and structuring the data, enhancing accessibility, security, and long-term data preservation, which are currently limited under the traditional system.

The current method, relying on physical files, not only consumes time when searching for specific documents, but also exposes data to the risk of physical damage from fire, water, or other calamities. In addition, the limited access to physical files hinders the full utilization of valuable research data, as only a small number of people can access the data at any given time, and students are dependent on their supervisor's availability to access research materials. These issues could be alleviated by moving to a digital system that offers centralized access, eliminating the need for physical storage space and reducing the risk of data loss.

By implementing a web-based database management system, such as the proposed Ndata system, the university would provide a platform that supports secure access for students and faculty members, allows real-time updates to dissertation data, and enhances collaboration across various departments. Furthermore, the system could be designed to ensure compliance with ethical standards and university policies, as it can easily integrate security protocols to control access based on roles and responsibilities. Such a system

would not only improve the efficiency of managing and retrieving data but also contribute to a more robust and scalable framework for future research, teaching, and policy development. It would support the institution's goal of fostering innovation in research while safeguarding the integrity and accessibility of academic data.

Ethics and professionalism

Ethics and professionalism are critical when it comes to managing dissertation data, especially in an academic setting such as the Malawi University of Science and Technology (MUST). The handling of research data involves several key ethical considerations, including ensuring data quality, protecting the rights of individuals involved in the research, and maintaining transparency and accountability in the research process. Given the challenges described in the background and problem statement, it is important to address these ethical concerns through the implementation of a secure, efficient, and professional data management system.

Ethical considerations

Firstly, the developed system ensures efficiency and accessibility. Dissertation data often includes sensitive information about research findings, methodologies, supervisor and participant information. It is essential to ensure that personal and confidential information is securely stored and accessed only by authorized individuals (Borgman, 2015). Traditional paper-based systems lack the security features necessary to protect this information from unauthorized access, accidental loss, or physical damage. By transitioning to a digital database system, like the proposed Ndata web-paged system, Malawi University of Science and Technology can implement role-based access control to ensure that only relevant parties such as anonymous users and system administrators can access specific data. This would uphold the ethical principle of confidentiality, ensuring that sensitive data is handled with care (National Institutes of Health [NIH], 2018).

Secondly, it also provides data integrity and quality. Research data must be accurate, reliable, and complete to support the integrity of academic research. This is attained since the system does not allow the administrator to upload incomplete data (Michener,

2015). This digital shift would ensure that research data is preserved in its original form and can be accessed accurately by future researchers, supporting ethical research practices.

Thirdly, it provides compliance with ethical guidelines. Academic research is governed by strict ethical standards, including guidelines on data management, consent, and participant protection (British Psychological Society [BPS], 2021). The traditional file-based system does not adequately support compliance with these guidelines, as it lacks features for managing permissions and auditing access. A web-paged system can is designed to incorporate compliance checks and allow researchers to document their adherence to ethical standards i.e. if confidentiality agreements are followed, supporting ethical research practices and minimizing the risk of violations (European Commission, 2018).

Professionalism

Professionalism in data management requires a system that is efficient and accessible to all relevant stakeholders. The traditional system is slow, cumbersome, and prone to human error, which impedes the flow of information between students, supervisors, and other researchers (Whyte & Tedds, 2011). A web-paged system would improve efficiency by enabling easy searching, retrieval, and updating of dissertation data. By making the data more accessible, it would allow researchers to spend more time analyzing and applying the data, rather than searching through physical documents, thereby promoting a more professional and productive research environment.

Professionalism also entails protecting research data from external threats, including natural disasters, theft, or unauthorized access. Traditional paper-based systems are vulnerable to such risks, whereas a digital system can be designed with backup protocols and disaster recovery plans to protect data integrity. Additionally, data security features and secure access mechanisms would ensure that research data remains protected and accessible only to those who are authorized administrators, reflecting a high standard of professionalism in data management.

A professional data management system promotes collaboration by allowing multiple users to access and contribute to the research data in real time. The proposed web-paged

system would provide students, lecturers, and other researchers with the ability to easily share data, collaborate on research projects, and provide feedback (Tenopir et al., 2011). This encourages a cooperative research environment where professionalism is demonstrated through teamwork and the sharing of knowledge.

Appendix

Appendix 1

```
// Import the functions you need from the SDKs you need
import { initializeApp } from "firebase/app";
import {getAuth} from 'firebase/auth'
import {getStorage} from 'firebase/storage'
import {getFirestore} from "firebase/firestore"
// TODO: Add SDKs for Firebase products that you want to use
// https://firebase.google.com/docs/web/setup#available-libraries
// Your web app's Firebase configuration
// For Firebase JS SDK v7.20.0 and later, measurementId is optional
const firebaseConfig = {
  apiKey: "AIzaSyDigNqre1I2lgWNVUmxV6zmCfEc4XT9toc",
  authDomain: "wews-7fc10.firebaseapp.com",
  projectId: "wews-7fc10",
  storageBucket: "wews-7fc10.appspot.com",
  messagingSenderId: "883100704316",
  appId: "1:883100704316:web:5b025ed3152ec4de936d39",
  measurementId: "G-K4PHTC6N2Y"
};
// Initialize Firebase
const app = initializeApp(firebaseConfig);
const auth = getAuth(app)
const db = getFirestore(app)
const storage = getStorage(app)
export {auth,db,storage}
export default app
```

Appendix 2

```
import { signInWithEmailAndPassword, createUserWithEmailAndPassword } from
"firebase/auth";

import { collection, getDocs, doc, getDoc, writeBatch, query, where, limit, deleteDoc }
from "firebase/firestore";

import { auth, db, storage } from "./firebase";

import { UploadTask, ref, uploadBytesResumable, UploadTaskSnapshot,
getDownloadURL } from "firebase/storage";



export const customSplit = (word : string)=>{
    const split = word.split(" ")
    const mySplits : string[] = []
    split.forEach((_, index)=>{
        const slice = split.slice(0,index)
        const concat = slice.join(" ")
        mySplits.push(concat)
    })
    split.push(...mySplits)
    return split.map(x=>x.toLocaleLowerCase().trim())
}
export interface User{
    firstName : string;
    lastName : string;
    email : string;
    phoneNumber : string;
    role : ROLE;
    notificationCount : number,
```

```
    avatarUrl : string
}

export const MDD = "MDD" as const

export type School = "NDATA" | "BINGU" | "MIT" | "MEDICAL"

export type StudyAreaType  = "IMAGE" | "GEOJSON"

export type ROLE = "STUDENT" | "ADMIN" | "INSTRUCTOR"
export interface Disertation{
    school : School;
    author : User;
    supervisor : User;
    id: string;
    abstract : Abstract;
    studyArea : StudyArea;
    createdAt : Date;
    queries : string[];
    student : User


}


export interface Abstract{
    title : string;
```

```
    content : string;


}


export interface StudyArea{
    type : StudyAreaType;
    uri : string
}


export interface UserLoginCredentials{
    email : string;
    password : string;
}


export interface CommitResult{
    message : string;
    status : boolean;
}


export const login = async(credentials : UserLoginCredentials,onSuccess : (user : User)=>
void, onFailure : (result : CommitResult)=> void)=>{
    try {
        await
signInWithEmailAndPassword(auth,credentials.email,credentials.password).then(async()=
>{
            const userDoc = collection(db,`Users/${credentials.email}/userData`)
            const data = await getDocs(userDoc)
            const user = data.docs[0].data() as User
```

```
            onSuccess(user)
        })

    } catch (error) {
        console.log(error);

        onFailure({message : "login failed", status : false})
    }

}



export const checkIfMemberExists = async(email : string,onUserFound : (userFound : User)=> void, onUserNotFound : ()=> void, onerror : ()=> void)=>{
    try {

        const userDoc = doc(db,`Users/People/Members/${email}`)
        const data = await getDoc(userDoc)
        if(data.exists()){
            const user = data.data() as User
            return onUserFound(user)
        }else{
            onUserNotFound()
        }
    } catch (error) {
        onerror()
        console.log(error);
```

```
    }
}


export const register = async (user : User, password : string, onSuccess : (user : User)=> void, onFailure : ()=> void)=>{
    try {
        const {email} = user
        await createUserWithEmailAndPassword(auth,email,password)
        await  addUserToStorage(user,()=>{
            onSuccess(user)
          },()=>{
           onFailure()
          })
          onSuccess(user)



    } catch (error) {
        onFailure()
    }


}


const addUserToStorage = async(user : User, onSuccess : ()=> void, onFailure : ()=> void)=>{
    try {
        const userDoc = doc(db,`Users/${user.email}/userData/${user.firstName}`)
        const peopleDoc = doc(db,`Users/People/Members/${user.email}`)
        const batch = writeBatch(db)
```

```
        batch.set(userDoc,user)
        batch.set(peopleDoc,user)
        await batch.commit().then(()=>{
            onSuccess()
        })

    } catch (error) {
        console.log(error);
        onFailure()

    }
}

export const submitDisertation = async(dissertation : Disertation, onSuccess : ()=> void, onFailure : (error : CommitResult)=> void)=>{
    try {

        const dissertationDocument = doc(db,MDD+"/dissertation/data/" + dissertation.id)
        const userDisertationReference = doc(db,"User/"+dissertation.author.email+"/dissertation/" + dissertation.id)
        const batch = writeBatch(db)
        batch.set(dissertationDocument,dissertation)
        batch.set(userDisertationReference,{id:dissertation.id})
        await batch.commit().then(()=>{
            onSuccess()
        })
```

```
    } catch (error) {
        console.log(error);
        onFailure({message : "An error occured while submiting your dissertation, please try again",status : false})

    }
}

export const deleteDissertation = async(dissertation : Disertation, onSuccess : ()=> void, onFailure : ()=> void)=>{
    try {
        const dissertationDocument = doc(db,"User/"+dissertation.author.email+"/dissertation/" + dissertation.id)
        const dissertationDocument1 = doc(db,MDD+"/dissertation/data/" + dissertation.id)
        const batch = writeBatch(db)
        batch.delete(dissertationDocument)
        batch.delete(dissertationDocument1)
        await batch.commit().then(()=>{
            onSuccess()
        })
    } catch (error) {
        console.log(error);
        onFailure()

    }
}
```

```
export const getAllDAta = async() : Promise<Disertation[]>=>{
    try {
        const databaseCollection = collection(db, MDD+"/dissertation/data");
        const data = await getDocs(databaseCollection)
        const results = data.docs.map(x=> x.data()) as Disertation[]
        return results
    } catch (error) {
        console.log(error);
        return []



    }




}
export const searchDissertation = async (keyWord: string): Promise<Disertation[]> =>
{
    try {
      const trimmedKeyword = keyWord.trim();
      const databaseCollection = collection(db, MDD + "/dissertation/data");
      if (!trimmedKeyword) {
            const myData = query(databaseCollection,limit(20))
            const docs = (await getDocs(myData)).docs.map(x=> x.data()) as Disertation[]
            return docs
      }
      const searchTerm = trimmedKeyword.toLowerCase();
```

```
      const fields = searchTerm.split(" ");


      // Use only one where condition
      const myQuery = query(databaseCollection, where("queries", "array-contains-any",
[searchTerm]));


      const data = await getDocs(myQuery);
    //   const results = (data.docs.length > 0 ? data : await
getDocs(query(databaseCollection, where("queries", "array-contains-any", [fields])))
).docs.map((x) => x.data() as Disertation);
    const results = data.docs.map((x) => x.data() as Disertation);
      return results;
    } catch (error) {
        console.error("Error searching dissertations:", error);
        return []
        // throw error;
    }
  };




export const uploadFile = async (
    email: string,
    title : string,
    fileName: string,
    file: File,
    onProgressChange: (progress: number) => void,
```

```
    onPause: (isPaused: boolean) => void,
    onRun: (isRunning: boolean) => void,
    onCancel: (isCanceled: boolean) => void,
    onTask: (task: UploadTask) => void,
    onFinish: (downloadUri: string | null) => void
) => {
    if (typeof window === "undefined") {
        console.error("Firebase storage cannot be used on the server.");
        return;
    }

    try {
        const imageRef = ref(
            storage,
            MDD+`/images/${email}/${title}/${fileName}`
        );

        const uploadTask = uploadBytesResumable(imageRef, file);
        onTask(uploadTask);

        uploadTask.on(
            "state_changed",
            (snapshot: UploadTaskSnapshot) => {
                const progress = snapshot.bytesTransferred / snapshot.totalBytes;
                onProgressChange(progress * 100);
                console.log(`Upload is ${Math.round(progress * 100)}% done`);
```

```
            const newState = snapshot.state;

            onPause(newState === "paused");
            onRun(newState === "running");
            onCancel(false);
        },
        (error) => {
            console.error("Upload failed:", error);
            onCancel(true);
            onPause(false);
            onRun(false);
            onFinish(null);
        },
        async () => {
            try {
                const uri = await getDownloadURL(uploadTask.snapshot.ref);
                onFinish(uri);
                console.log("Download URI:", uri);
            } catch (error) {
                console.error("Failed to get download URL:", error);
                onFinish(null);
            }
        }
    );

} catch (error) {
    console.error("Upload error:", error);
```

```
        onCancel(true);
        onPause(false);
        onRun(false);
        onFinish(null);
    }
};
```

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