



Department of Computer Science

## COMP4200 - Introduction to Graduation Project

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### Birzeit Archive – Municipal Archiving and Management System

#### Authors

Qosai Badaha	(ID: 1210469)
Abdalkarim Abusalama	(ID: 1223166)
Noor Samhan	(ID: 1211023)

Supervisor: Dr. Ahmed Abusnaina

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## Section – B

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## Section – C

**Student Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Submitted:** \_\_\_\_\_

**First Supervisor Name:** \_\_\_\_\_

**First Supervisor Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Approved:** \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

# Abstract

Municipalities often face challenges in communication between their departments, especially when it comes to exchange official documents. Efficient interdepartmental communication is essential for completing municipal transactions. With the increasing number of transactions and ongoing technological advancements, municipalities require a system that facilitates communication and reduces reliance on paper-based processes.

This application provides municipal employees with a mechanism for digital communication between departments, enabling easy file sharing without the need for paper correspondence. The system is designed to categorize transactions in a way that allows employees to retrieve files quickly and efficiently, minimizing the use of physical documents.

The main goals of the application are to enable fast communication between municipal departments, track correspondences without paper copies, and offer a user-friendly interface to simplify the uploading and transfer of files. Additionally, the system includes an automated file classification mechanism that improves file retrieval while ensuring privacy. Only authorized personnel within each department can access the files relevant to their own section.

Implementation will rely on a PHP framework (Laravel) and MySQL for back-end services, while the front end will be built with HTML5, CSS3 and native JavaScript to handle file uploads, navigation and dynamic interactions. All core business logic—authentication, session management, file handling and inter-departmental workflows—will reside within Laravel, which will enforce role-based access so that each department only sees its own documents. Transaction metadata, user accounts and classification labels will be maintained in MySQL. A built-in categorization mechanism will automatically tag and organize incoming documents to streamline retrieval.

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# Chapter 1

## Introduction

### 1.1 General overview

In the modern era of digital transformation, municipalities are increasingly expected to adopt advanced technological solutions to improve public service delivery, transparency, and internal administrative efficiency. Traditional methods of managing citizen requests, employee operations, document processing, and reporting are no longer sufficient to meet the growing demands of both the public and internal staff. Hence, there is a strong need for smart systems that streamline communication, automate workflows, and ensure accurate documentation and record-keeping.[1]

This project proposes the design and development of an integrated Municipal Management and Archiving System tailored for Birzeit Municipality. The system is intended to serve multiple user roles—each with specific permissions and access levels. It provides a structured platform through which users can engage in various functions, including submitting and tracking complaints, applying for construction or commercial licenses, managing employee records, and archiving official documents and reports. The system is designed to be intuitive, role-based, secure, and scalable to accommodate future enhancements.

The system provides users, such as employees, with tools for efficiently managing service requests, publishing content, and accessing the digital archive. The director's panel offers high-level oversight of all activities, facilitates official communication through notices, and enables the approval or rejection of department-level reports.

A core component of the system is its digital archiving functionality, which supports the upload, classification, and tracking of a wide range of documents (e.g., PDF files, scanned forms, images). The archive is searchable through advanced filters such as date, status, and document type. Additional features include logging updates made to files, applying statuses like "Under Review" or "Approved," and exporting data in formats like PDF and Excel for reporting purposes.

The system also emphasizes security and accessibility by implementing role-based access control (RBAC), allowing users to interact only with features relevant to their role. Sensitive data such as employee information and administrative documents are securely stored and access-logged to ensure accountability.

## 1.2 Motivation

Municipalities often face challenges in communication between departments, especially when relying on paper-based correspondence. These outdated methods can lead to delays, misunderstandings, and inefficiencies in handling municipal transactions. As the volume of transactions increases due to urban growth and technological advancement, the limitations of traditional communication become more apparent.

To address these issues, there is an urgent need for a digital solution that facilitates seamless communication between municipal departments. Such a system would not only streamline the exchange and retrieval of information but also reduce dependence on physical documents, thereby enhancing operational efficiency.

Our proposed application aims to provide a secure and user-friendly platform for municipal employees to efficiently share files and messages. By implementing automated file classification and access control mechanisms, the system ensures that information is only accessible to authorized personnel. This approach is expected to significantly improve the speed and reliability of interdepartmental communication within municipalities.

## 1.3 Aim and Objectives

The primary aim of this project is to build a user-friendly municipal system that facilitates service delivery and internal management for Birzeit Municipality.

Objectives include:

- Providing departments with an integrated platform to manage and track service requests efficiently, ensuring timely processing and inter-departmental coordination.
- Establishing a centralized digital archiving system that supports structured document classification, fast retrieval through advanced search capabilities, and options for exporting records when needed.
- Enforcing a secure, role-based access control mechanism to ensure that each user interacts only with the data and features relevant to their role and authorization level.
- Enhancing overall transparency, accountability, and documentation across the municipality by digitizing workflows and minimizing reliance on manual procedures.

## 1.4 Overview of the technical area

This project lies within the domain of web-based information systems and incorporates aspects of:

- **Database design and management** for storing structured data securely.
- **Web development** for creating dynamic, interactive user interfaces.
- **Document management systems** for archiving and classifying files.
- **User authentication and access control** based on predefined roles.
- **Workflow automation** and task tracking to streamline operation.
- **Data reporting and visualization** for administrative decision-making.

The system uses a combination of front-end and back-end technologies and adheres to best practices in software architecture, security, and usability.

## 1.5 Overview of the report

**Chapter 1:** Introduction This section outlines the goals and objectives of the project, providing a foundational context regarding what the project seeks to accomplish. It also illustrates the motivation for undertaking this project and describes how it was carried out.

**Chapter 2:** Background Here we outline several pertinent systems and associated prior work that inform this project. It contains a review of the literature as well as other tools and technologies that are going to be used in developing Municipal Archiving and Management System.

**Chapter 3:** System Analysis In this chapter, an in-depth description of the system is given; product description, system objectives, core functionalities, main features, operating environments and more are included. Also covered are constraints including functional and non-functional requirements along with an elaborate model of the system. Several UML diagrams (use case, class, sequence, activity and state chart) are provided towards depicting the architecture of the system and its components.

**Chapter 4:** Conclusion and Future Works This last chapter presents a comprehensive review of project outcomes including key findings alongside outlining significance derived from devising such a developed system discussing also potential future works focusing on additional enhancements aimed towards optimizing further technofunctional systemic capabilities while sustaining minimalistic operational footprint maximising impact.

# Chapter 2

## Background

### 2.1 Details of relevant theory

Municipal information systems represent a critical component of modern e-Government frameworks, which aim to digitize public services, increase transparency, and streamline administrative processes through the use of advanced information and communication technologies (ICTs). The theoretical underpinnings of the proposed system are based on the following key areas:

- **Document Management Theory:**

This theory provides the foundation for systematic handling of documents throughout their lifecycle. It includes the use of metadata standards, classification schemas, and indexing strategies to ensure efficient archiving, retrieval, and long-term preservation of municipal records. The proposed system incorporates these principles to digitize paper-based workflows and organize documents in a searchable, structured manner.[2]

- **Access Control Models:**

The system applies Role-Based Access Control (RBAC), a widely accepted model in secure information systems. Under RBAC, permissions are assigned to roles rather than individual users, ensuring that each user interacts only with the functionalities and data pertinent to their job responsibilities. This enhances both security and operational clarity across municipal departments.[3]

- **Workflow Automation:**

Grounded in Business Process Model and Notation (BPMN), the system supports the modeling and automation of recurring municipal operations such as handling citizen complaints, processing leave requests, and issuing permits. Automating these workflows reduces manual intervention, improves processing time, and ensures consistent service delivery.[4]

- **Software Architecture Models:**

The proposed system follows a three-tier architecture comprising presentation, application logic, and data layers. This modular structure promotes scalability, simplifies maintenance, and allows for clear separation of concerns between user interfaces, business rules, and data management. [5]

## 2.2 Review of past/reported work

Several municipalities around the world have successfully implemented digital archiving and e-Government platforms to improve efficiency and citizen engagement:

- **Dubai Municipality's Smart Services:**

Through the "Smart Dubai" initiative, Dubai seeks to transform the city into a smart city, aiming to improve the quality of life and increase the happiness of residents and visitors. This is achieved by adopting the latest digital governance technologies and the electronic transformation of municipal services and document management.[6]

- **An Overview of Digital Transformation in Dubai:**

Dubai embarked on its digital transformation journey in the early 2000s, launching the "eGovernment" initiative to transform traditional government services into digital services available online and via mobile phones. By 2013, approximately 95% of government services were available online, a figure considered a global benchmark.

With this development, the Smart Dubai Office was established as a central entity overseeing the city's smart transformation and coordinating between government and private entities to ensure the implementation of digital transformation initiatives in an integrated and comprehensive manner.

- Dubai's electronic municipality system includes an integrated set of digital services, including:

- \* Digitizing and archiving administrative and municipal documents using unified, smart systems that ensure easy access and high security.
- \* Linking databases across various government departments and agencies to avoid data duplication and provide information instantly.
- \* Implementing strict standards for classifying data into open data and shared data (confidential or sensitive) to ensure privacy and data protection.
- \* Establishing a unified platform for municipal data management that enables secure data sharing among relevant entities and facilitates decision-making.
- \* Using advanced technologies such as artificial intelligence and data analysis to enhance the city's smart management capabilities.[7]

### **Key Features of the E-Municipality System and Document Archiving :**

- \* Data Integration and Smart Archiving: Linking data across various government departments creates a unified system for document archiving, reducing duplication and redundancy, while providing fast and efficient search and retrieval mechanisms.
- \* Privacy and Security Protection: Adopting clear data classification in accordance with the Dubai Data Law, where data is classified as open or shared based on the sensitivity of the information, with strict oversight mechanisms in place to control data access.

- \* Accessibility and Interaction: Providing a unified electronic portal that allows citizens, residents, and businesses to access municipal services and documents easily and quickly, with full support for mobile access.
- \* Transparency and Community Participation: Encouraging the publication of non-sensitive data as open sources to support community engagement, foster innovation, and stimulate data-driven businesses.
- \* Improving Government Efficiency: By automating municipal processes and digitally archiving documents, the time required to complete transactions has been reduced and coordination between various entities has been improved.
- \* Data-Driven Decision-Making Support: Leveraging digital data and document archives for advanced analytics to assist decision-makers in strategic planning and the delivery of high-quality services.
- \* Flexibility and Continuous Update: The smart office's organizational structure can continually adjust laws and policies to keep pace with rapid developments in technology and data. [8]

- **Palestinian e-Government Initiatives:**

In recent years, the Palestinian government has begun digitizing its services by launching a unified electronic portal for government services (the "My Government" platform), which aims to facilitate citizens' access to multiple services through a single platform spanning multiple ministries and government agencies. This transformation comes within the context of a global trend toward e-government, but it faces unique political, social, and economic challenges unique to Palestine. The e-Government System in Palestine.[9]

A unified electronic platform called "My Government" was launched in late 2022, allowing citizens to access multiple services from various ministries and agencies (such as the Ministry of Interior, Finance, Transportation, Health, Labor, Justice, the Land Authority, and the Supreme Judicial Council).

This platform provides e-services at various levels, including government-to-citizen (G2C), government-to-business (G2B), and government-to-government (G2G).

The platform aims to unify access points and provide an easy-to-use interface to facilitate service delivery and reduce field visits to government offices.

### **Digital Document Archiving in Palestine Digital archiving**

is an integral part of the e-transformation, where government documents are digitized and stored electronically in central databases.

This system enables secure document storage, easy search and retrieval, improved document preservation quality, and reduced loss or damage associated with paper archives.

Digital archiving helps enhance transparency and administrative efficiency by enabling faster and easier access to government data and documents.

The existence of a central electronic archiving system contributes to unifying and linking data from various government agencies, supporting decision-making processes and improving coordination between institutions.

### **The Importance of Digital Archiving in the Palestinian Context**

- Digital archiving reduces the need to travel between government agencies, which is critical given the security restrictions imposed by the Israeli occupation, such as roadblocks and checkpoints, where citizens suffer harassment and significant delays.
- This technology contributes to protecting citizens' rights and facilitating access to official documents electronically without the risk of travel.

### **Challenges Associated with Digital Archiving in Palestine**

- The political and administrative division between the West Bank and the Gaza Strip has led to the existence of disparate systems and tools in both regions, making it difficult to fully unify digital archives.
- The weak technological infrastructure and the lack of stable internet access in some areas affect the quality of access to electronic archiving services.
- The lack of legal legislation regulating data protection and privacy is an obstacle to the expansion of the use of digital archiving.
- Continuous training is needed for government personnel to develop skills in dealing with digital systems.
- Citizens' concerns about security and privacy affect their full adoption of digital services.

### **Future Developments**

The Palestinian government is working to develop the electronic platform to include more services and enhance integration between ministries.

There is a trend toward using modern document management technologies, such as artificial intelligence, to improve archiving and search processes.

Increasing citizen awareness and confidence through educational and awareness campaigns that contribute to increasing the use of electronic services.

Efforts are being made to establish legislative and regulatory frameworks that protect data and ensure the integrity of digital archives. While progress has been made in larger urban centers, smaller municipalities—such as Birzeit—continue to rely on manual, paper-based systems.

[10]

- **EXPAND systems:**

An Industry Leader In Palestine And The Middle East That Offers Specialized, Top-Notch Services In The Fields Of Institutional Building Construction And Business Administration Employing Information Systems, Technology, And Digital Solutions.

Some municipalities use this program within Palestinian municipalities to reduce paper communication between municipal departments, speed up communication between them, and better track correspondence.

Employees type the contents of the correspondence or document once when entering it for the first time using the keyboard, and then it is transferred to other departments in a paperless format, where other departments can see and track it.[11]

- **Jeddah Municipality, Saudi Arabia:**

In Saudi Arabia's Jeddah Municipality, digital governance strategies included completing a full digitization project of physical records. During two years of work within the frame of collaboration with UAE's National Library and Archives, formal policies alongside procedures for managing municipal records were created as part of an electric archiving system. Reports from regional conferences on archiving indicate that projects also provided rules for managing not only active documents but also semi-active records in the city's archive.

The automated workflow designed within the Jeddah municipal framework ensures documents are uniformly archived and retrieved which helps preserve city records while improving access to them over time. This showcases successful cross-border government cooperation in providing expert assistance: NLA's team modernized Jeddah's municipal archive and the system is currently operational managing the city's documents.[12]

- **Technology Used:** Jeddah Municipality's digital archiving system was built using Java for backend processes and PHP for web interfaces. The system utilizes MySQL as the database management system (DBMS).
- **Platform:** The archiving solution is a custom web-based platform that includes a document scanning module to capture physical documents and store them digitally in the system.
- **Database:** Oracle Database was used for its ability to handle a high volume of transactional data and to ensure data integrity in the archive system.
- **Additional Tools:** The system uses PDF/A format for long-term digital preservation and OCR technology to make scanned images searchable.

- **Jericho Municipality, Palestine:**

Located in the West Bank of Palestine, Jericho Municipality is renowned for pioneering technology advancements after implementing a digital archiving system in 2005. This was reported in a municipal report that detailed the commencement of an electronic archiving system EFT-based with local service provider ATS – Arab Technical Systems.

Its data management system automated and digitized all city correspondence and records. To enhance confidentiality, user-based access control is utilized whereby each user has a unique code. In addition to safeguarding important documents from physical damage due to deterioration, automation simplifies workflow.

The municipality's documentation of these experiences illustrates the applied solution even smaller cities Middle Eastern cities have long embraced computing despite limited resources; digital archiving and records management system enhances efficiency while protecting vital municipal documents.[13]

- **Technology Used:** The digital archiving system at Jericho Municipality was primarily built using Java-based solutions for backend processing. The frontend was powered by HTML, CSS, and JavaScript to create a user-friendly web interface.
  - **Platform:** The platform is based on a custom web application with built-in search functionality. The solution was integrated with a local cloud storage provider to store municipal records.
  - **Database:** The platform is based on a custom web application with built-in search functionality. The solution was integrated with a local cloud storage provider to store municipal records.
  - **Additional Tools:** OCR technologies were implemented for converting paper documents into digital, searchable formats. The system also includes role-based access control (RBAC) to ensure that only authorized users can access sensitive records.
- **Sfax, Tunisia:**

The city of Sfax in Tunisia showcases one of the best examples of a fully implemented digital municipal archiving system. As part of the “Sfax Digital City” project, the municipal archives were fully scanned, and an electronic document management system (EDMS) was established.

This system has been deployed in practice enabling city departments to manage records through maintained files electronically instead of using paper. Significantly, Sfax's initiative on digital archives also included public services: residents can now access e-municipal services like applying for various permits as well as settling local taxes through the new platform.

The Sfax case study illustrates how digitizing city archives enhances administrative efficiency improves and government services available to citizens. [14]

- **Technology Used:** : The Sfax Digital City project leveraged an integrated digital archiving system built around web technologies. The system primarily

used Java-based solutions for backend processing, with HTML5, CSS3, and JavaScript for frontend development.

- **Platform:** system utilized open-source frameworks for document management and workflow automation. It also incorporated cloud storage solutions to ensure scalability.
- **Database:** The digital system used MySQL for storing metadata and document indexing.
- **Additional Tools:** For scanning and document processing, the municipality deployed OCR (Optical Character Recognition) technologies to convert paper records into searchable digital formats.

**Gap Analysis: The Case of Birzeit Municipality** Despite global advancements, local municipalities such as Birzeit face challenges in adopting digital systems. Most internal processes still depend on physical documentation and handwritten approvals, leading to inefficiencies, delays, and poor data traceability. The proposed system addresses this gap by introducing an integrated digital archiving and workflow platform tailored to the specific needs of Birzeit Municipality. By doing so, it seeks to:

- Improve service delivery speed and accuracy.
- Reduce administrative overhead.
- Lay the groundwork for broader digital transformation initiatives.

### **Digital Transformation Strategy and Its Role in Developing Municipal Service Management**

This study covers the role of digital transformation strategies in enhancing municipal service management, with a focus on a case study in Oman. It discusses how municipalities can adopt digital tools to better manage services and resources.

Digital transformation holds immense potential for improving municipal service management, fostering efficiency, transparency, and citizen satisfaction. However, its success depends on addressing technical, organizational, and policy barriers while fostering a culture of innovation and inclusivity.

To elaborate, municipalities need to invest in robust technological infrastructure that supports seamless integration of digital services. This includes cloud computing, cybersecurity measures, and interoperable systems that enable different departments to share data effectively.

Organizational readiness is equally important; employees must be equipped with the necessary skills and training to adapt to new technologies, and resistance to change should

be managed through clear communication and involvement of all stakeholders.[15]

### **Case Study: Using Artificial Intelligence to Improve Municipal Response**

The study titled "Improving Municipal Responsiveness through AI-Powered Image Analysis in E-Government" by Catalin Vrabie explores the integration of machine learning (ML) techniques, particularly image analysis, into public administration to enhance municipal responsiveness. Traditionally, e-government systems have focused on text-based interactions; this research introduces an innovative approach by utilizing ML for analyzing citizen-submitted images, such as photographs of infrastructure issues or environmental concerns.

The research utilizes a Romanian municipality as a case study, analyzing datasets of citizen-submitted images to demonstrate the practical application and benefits of ML in municipal responsiveness.

The study underscores the transformative potential of AI in municipal service delivery, advocating for the adoption of ML techniques to enhance operational efficiency, transparency, and citizen satisfaction in e-government systems.[16]

Table 2.1: Comparison Table

Project	Key Features	Technologies Used	Comparison with our System
Dubai Municipality	Smart archiving, AI integration, unified data platform, data classification	AI, OCR, centralized DBs, custom smart systems	More advanced in scale and integration; shares concepts like smart archiving and RBAC
Palestinian e-Gov ("My Government")	Centralized digital services, digital archiving, multi-agency integration	Web-based portal, central DBs, service unification	Broader national scope; our system is more specialized and technically detailed for one municipality
Jeddah Municipality	Full digitization of records, RBAC, OCR, inter-governmental cooperation	Java, PHP, Oracle DB, PDF/A, OCR	Uses heavier stack; similar in RBAC and digitization focus
Jericho Municipality	Web archiving system, role-based access, document digitization	Java backend, HTML/CSS/JS frontend, local cloud, OCR	Similar architecture and security, but lacks automated file classification
Sfax (Tunisia)	City-wide EDMS, citizen e-services, digital payments, cloud-based archives	Java, MySQL, HTML5, open-source DMS, OCR	Closest in terms of tech (MySQL, OCR); broader in services (citizen-facing)
EXPAND Systems (Palestine)	Reduces paper communication between municipal departments, speeds inter-department communication, tracks correspondence digitally	Custom digital communication platform, institutional building and business admin solutions	Similar goal of paperless communication; less focus on automated classification
Our System	Internal e-archiving and inter-department file sharing, auto-tagging, fast search, RBAC	Laravel (PHP), MySQL, HTML5, CSS3, JS, automatic classification based on metadata	Lightweight, focused, and efficient; emphasizes smart internal workflows

## 2.3 Tools and Technology

The proposed system employs widely adopted, open-source technologies that align with the project's scalability, maintainability, and security goals.

### 2.3.1 Front-End Technologies

The user interface is developed using HTML, CSS, and JavaScript, with React.js providing a responsive, component-based architecture for dynamic interaction.

#### HTML

HTML (HyperText Markup Language) is integral to structuring a website since it acts as the framework for the content of each web page. HTML elements utilized by developers in building the website are signaled by tags containing particular data.

As in such, they can include headings, paragraphs, lists, images, videos, hyperlinks and many other elements. While reading an HTML document, browsers “read” between the tags and generate the associated layout as well as graphical presentation . With CSS (Cascading Style Sheets) and JavaScript being later added[17].

HTML lays the foundation for CSS (Cascading Style Sheets) and JavaScript, which add



Figure 2.1: HTML Logo

styling and interactivity to the website, respectively. Well-organized HTML is vital for website success. Clear and concise design of elements helps users navigate the website easily, ensuring they find the information they need quickly. Additionally, effectively organized HTML helps search engine crawlers index and understand your content better, leading to higher search engine rankings and improved SEO.

#### CSS

Web pages, as users experience them, are a sophisticated interplay of content, structure, and visual presentation. At the core of this presentation layer lies Cascading Style Sheets (CSS), a fundamental language that dictates the aesthetic and layout of web documents. Alongside HyperText Markup Language (HTML) for structure and JavaScript for interactivity, CSS is one of the three main technologies employed in building websites. It

transforms the raw, semantic content provided by HTML into the rich, engaging, and user-friendly interfaces seen across the internet [18]. CSS utilizes rules to control the



Figure 2.2: CSS Logo

styling and layout of web pages, thereby making their appearance much more interesting than plain HTML. This document explores the foundational principles of CSS, its syntax, methods of application, and its critical role in modern web design, including advanced layout techniques and considerations for web standards and browser compatibility. CSS rules can be integrated into HTML documents through several methods, each with its own advantages and common use cases:

- **External Stylesheets:** This is the most common method of applying CSS, as it provides the most flexibility. All rules are written in a separate .css file (e.g., styles.css) which is linked to the HTML document using <link> within <head>. This approach enables better reusability since one CSS file can define styles for multiple HTML pages. It also greatly enhances maintainability since style definitions are centralized.
- **Internal Stylesheets:** CSS rules are embedded directly within an HTML document by placing them inside a <style> tag, typically located within the <head> section. This method can be useful for single-page applications or when specific styles are unique to a particular HTML document and are not intended for reuse across a larger site.
- **Inline Styles:** An application of styling within an HTML document is done using the style attribute and can be found in the elements opening tag. Although this approach gives control over a single element, it is discouraged for more sophisticated designs as it makes the content harder to separate from the markup and that hinders readability of HTML. Maintenance or site-wide updates becomes challenging with such entwined styles.

## JavaScript

JavaScript's power stems from its core programming features and its extensive set of Web APIs [19]. **A. Interactivity and Dynamic Content** JavaScript allows developers to create dynamic and engaging user experiences by:

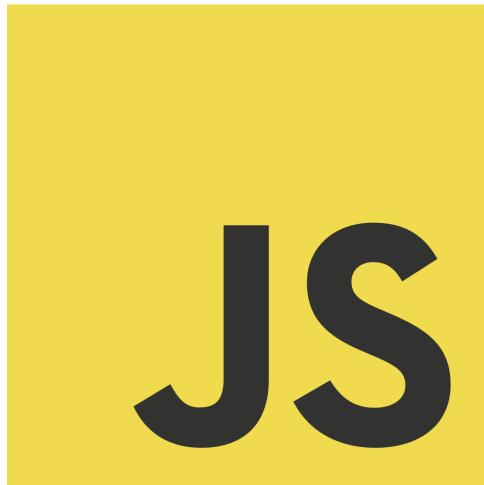


Figure 2.3: JavaScript Logo

- **Manipulating the Document Object Model (DOM):** The DOM API is a fundamental part of JavaScript, enabling it to create, remove, and change HTML elements, and dynamically apply new styles to a page. This is how pop-up windows appear or new content is displayed without a full page reload.
- **Event Handling:** JavaScript can respond to various user actions, such as clicks, keystrokes, and mouse movements. This capability is essential for implementing interactive features like dropdown menus, image sliders, and form validations.
- **Asynchronous Programming:** JavaScript's asynchronous nature allows multiple operations to run simultaneously without freezing the user interface. This is crucial for tasks like fetching data from servers in the background, ensuring a smooth and responsive application. Technologies like AJAX facilitate this real-time data exchange.

**B. Programming Constructs and APIs** The core client-side JavaScript language includes common programming features such as storing values in variables, performing operations on text (strings), and using control structures. Beyond these basics, JavaScript leverages various Web APIs to extend its capabilities:

- **Geolocation API:** Retrieves geographical information, enabling features like plotting a user's location on a map.
- **Canvas and WebGL APIs:** Allow for the creation of animated 2D and 3D graphics, facilitating rich visual experiences.
- **Audio and Video APIs:** (e.g., `HTMLMediaElement`, `WebRTC`) Enable interesting multimedia functionalities, such as playing audio/video directly in a web page or capturing video from a webcam.
- **Fetch API:** Provides a more ergonomic way to handle network requests.

## React.js

React.js, developed by Facebook, has become one of the most popular libraries for front-end development. This library provides a component-based architecture, making it easy

to build interactive and dynamic interfaces. React enables writing HTML and CSS within JavaScript, helping to build flexible and maintainable applications. **Key Advantages**

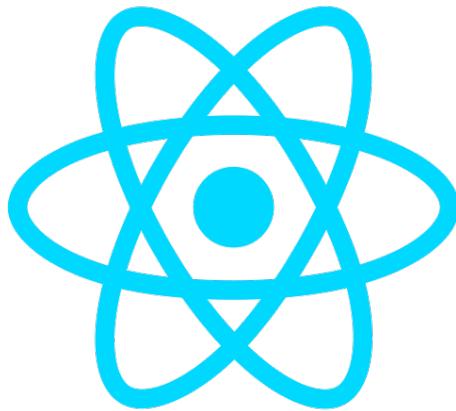


Figure 2.4: React.js Logo

#### of React.js:

- **Performance Efficiency:** React uses what is called "Virtual DOM", which improves user interaction performance by updating elements in memory without direct interaction with the actual DOM in the browser, thereby improving application speed.
- **Maintainability:** React relies on building applications using reusable components, making it easy to maintain and update code.
- **Dynamic Interaction:** React allows dynamic interface updates based on changes in component state, contributing to improved user experience.

#### Challenges and Accompanying Tools:

- **State Management:** Since React does not include an integrated mechanism for state management between components, solutions like Flux and Redux have been developed, which help in unidirectional data flow, making it easier to track changes across the application.
- **CSS Modules:** To address the challenges of managing CSS in large React applications, methods like CSS Modules have been developed that allow writing local CSS styles within components.

### 2.3.2 Back-End Technologies

The system logic is implemented using either PHP with the Laravel framework, or Node.js with Express.js. These frameworks support modular development, authentication mechanisms, and RESTful API integration.

## Introduction: The Core of Dynamic Web Applications

Modern web applications are fundamentally divided into two interconnected parts: the client-side (front-end), which users interact with, and the server-side (back-end), where the core system logic resides and data is managed. While the front-end handles the user interface, the back-end is responsible for dynamically changing website content, interacting with users through notifications or emails, processing HTTP requests, and connecting to databases [20].

## The Role of Back-End Frameworks

Back-end frameworks simplify the complex tasks involved in server-side operations, maintenance, and application scaling. They offer mechanisms for mapping URLs to specific handler functions, facilitating routing, and providing tools for database interactions, session management, user authorization, security against malicious attacks, and output formatting (such as CSV, HTML, JSON, and XML). By abstracting lower-level network primitives, frameworks allow developers to write simplified code to interact with higher-level requests and responses.

## PHP with Laravel

PHP remains a dominant language for building web back-ends, with frameworks like Laravel being widely used for large-scale web applications. Laravel offers a comprehensive suite of web-building components. Laravel supports a user token-based system for

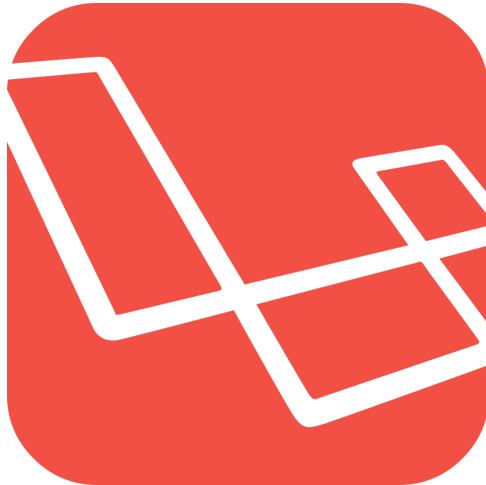


Figure 2.5: Laravel Framework Logo

authenticating multiple users simultaneously. It also includes features for caching, error handling, and log management. Its design minimizes bootstrapping and offers considerable flexibility, utilizing a Fast Route Library to efficiently direct requests to appropriate handler functions. Key Laravel features include:

- Modular development structure using MVC architecture
- Built-in authentication and authorization systems
- Eloquent ORM for efficient database operations

- RESTful API development capabilities
- Artisan command-line interface for development tasks

### Node.js with Express.js

Node.js allows JavaScript to be executed on the server-side, and Express.js stands out as a leading open-source framework built on Node.js. Express.js is known for its minimalist and non-restrictive nature, making it a popular choice among developers for building APIs and mobile applications. It is a key component of the MEAN stack (MongoDB, Express.js, Angular.js, and Node.js), which enables full-stack JavaScript development where both the server-side and client-side are written in JavaScript. Express.js provides a wide array of HTTP utility methods for constructing dynamic APIs. It offers robust routing functions based on URLs and HTTP methods, and its preconfigured plug-ins and template engines significantly reduce development and testing time. The framework's quick execution engines enable developers to create applications in comparatively less time. For authentication, Express.js can leverage middleware like Passport.js, which provides flexible authentication strategies. For instance, a system built with Express.js can allow users to log in using an email address and password, or through third-party services like Facebook or Google. For security, passwords are typically hashed using a package like bcrypt.js before being stored in the database, protecting against common attacks such as rainbow table and brute-force attacks.

#### 2.3.3 Database

##### MySQL

MySQL serves as the relational database management system, providing structured data storage, query optimization, and support for indexing and relationships. As a relational database, MySQL stores data in structured tables of rows and columns, organized into schemas that define data relationships [21]. This organization facilitates easy storage,



Figure 2.6: MySQL Database Logo

retrieval, and analysis of various data types, including text, numbers, dates, times, and even JSON. Keys, such as primary and foreign keys, are fundamental for connecting tables and enabling powerful queries. MySQL supports table relationships like one-to-one, one-to-many, and many-to-many. It also adheres to ACID properties (Atomicity, Consistency, Isolation, Durability), ensuring data integrity and reliability, especially with the InnoDB storage engine. **Comprehensive SQL Support** MySQL fully supports

standard SQL syntax and offers a rich set of functions, including grouping and ordering clauses, aggregate functions (e.g., COUNT, AVG, MAX(), MIN), and support for LEFT and RIGHT outer joins. It also provides MySQL-specific SHOW statements for detailed database information and supports the INFORMATION\_SCHEMA database. **Benefits in Web Development** MySQL's attributes translate into significant benefits for web development:

- **Foundation for Dynamic Websites:** It is crucial for creating dynamic websites and web applications that require complex data interactions, powering platforms like WordPress, Facebook, and Twitter.
- **Seamless Integration:** Its compatibility with popular web development technologies and programming languages simplifies the integration process, allowing developers to build robust applications efficiently.
- **Reliability and Maturity:** With extensive testing in various scenarios and use by many of the world's largest companies, MySQL is a mature and reliable choice for business-critical applications.
- **High Availability:** It offers native, fully integrated replication technologies for high availability and disaster recovery, ensuring minimal data loss and automatic failover for critical applications.
- **Strong Community Support:** A large and active developer community provides extensive support, bug fixes, and patches, making it a safe choice compared to less mature RDBMS technologies.

#### 2.3.4 Hosting Environment and Additional Tools

- **Hosting Environment:** The application is hosted on an Apache Web Server running on Windows Server, with options for cloud deployment to support future scalability and remote access.
- **Archiving Support:** The system integrates libraries such as TCPDF and jsPDF to handle document conversion and PDF generation. Metadata tagging and full text indexing are used to enhance search capabilities.

These tools were selected for their maturity, strong community support, and compatibility with the functional and security requirements of municipal information systems.

# Chapter 3

## System Analysis and Design

### 3.1 Overview

The system adopts a three-tier architecture model consisting of the following layers:

1. Presentation Layer: This is the user interface through which citizens, employees, or administrators interact with the system. It provides a simple and fast user experience.
2. Business Logic Layer: Contains the programming logic responsible for processing requests and executing operations such as submitting a complaint or approving a leave.
3. Data Layer: Includes the database where all information is stored such as user data, transactions, complaints, documents, and attendance records. This model ensures a clear separation between interface, logic, and data, making the system easier to maintain and extend in the future.

#### 3.1.1 Product Description

The system is a comprehensive web application designed to serve Birzeit Municipality digitally. The system automatically recognizes the type of document and classifies it according to the relevant department. The system enables municipal departments to exchange documents and transactions and track their status, whether pending, rejected, or ready. The system consists of several types of users. Each user has access to files related to his department or incoming transactions. The system administrator can manage user records, add, delete, or modify users, and send alerts for upcoming meetings.

#### System Objectives

- Digitize traditional municipal services.
- Facilitate submission and tracking of complaints and license requests by citizens.
- Enable employees to handle requests effectively.
- Archive official documents in a secure and organized manner
- Ensure information security and role-based access control.

- Generate reports and statistics to support managerial decision-making.

### 3.1.2 System Main Features

- Multi-role login ( Employee and Director).
- Role-based dashboard for each user type.
- User-friendly interface with full Arabic language support.
- Digital archiving with categorization, search, and export options.
- Internal alerts and notifications.

### 3.1.3 Operating Environments

- Browser: Chrome, Firefox, Edge.
- Server: Apache.
- Programming Language: PHP (Laravel) or JavaScript (Node.js).
- Database: MySQL.
- Fully supports deployment as a web-based platform (website) for online access.

### 3.1.4 Constraints

- The system requires a constant internet connection.
- Data protection requires high-level encryption, especially for documents and sensitive information.
- System compatibility depends on browser and server updates.
- The system must encrypt sensitive data both at rest and in transit.
- User roles and permissions are predefined and cannot be changed by end users.
- The number of concurrent users supported must exceed 10,000.
- The system must be designed with right-to-left (RTL) Arabic interface support.
- Certain departments may have exclusive access to specific types of records.

### 3.1.5 Functional Requirements

#### 3.1.5.a. User Management System

- 1.1. The system shall provide login functionality for different user roles: Employee, Director.
- 1.2. The system shall ensure role-based dashboards and permissions for each user type (e.g., Directors can access all departmental activities, each employee can access specific department).
- 1.3. The system shall allow admins to add, update, or delete users.

#### 3.1.5.b. Document Archiving System

- 2.1. The system shall store and retrieve documents in digital formats such as PDFs and images.
- 2.2. The system shall categorize documents by department or type.
- 2.3. Users shall be able to upload and download documents.
- 2.4. The system shall allow users to assign tags to documents for easier searching and classification.

#### 3.1.5.c. Internal Communication System

- 3.1. The system shall send and receive messages between departments.
- 3.2. The system shall provide notifications for new messages and updates (e.g., proof submissions, document requests).
- 3.3. Users shall be able to view and manage messages from their inbox.

#### 3.1.5.d. Notification System

- 4.1. The system shall send notifications about important events like new documents, messages, and upcoming meetings.
- 4.2. Notifications shall be sent by email.

### 3.1.6 Non-Functional Requirements

#### 1. Security

- Limit 12 characters, including capital letters, symbols, and lowercase letters.
- Logout after 15 minutes of inactivity.
- Ability for admins to add, update, or delete users.

#### 2. Performance

- User authentication:  $\leq$  2 seconds.
- Document upload/download:  $\leq$  5 seconds for files up to 100 MB.
- Dashboard loading:  $\leq$  3 seconds under 1000 concurrent users.

### 3. Usability

- The user interface fully supports Arabic (text, dates, numbers) with right-to-left (RTL) alignment.
- The intuitive design allows new employees to navigate the system without extensive training.

### 4. Reliability

- Provide user-friendly error messages in Arabic. Log errors for correction.
- Automatic daily data backup.

### 5. Maintainability

- Designing separate modules to facilitate upgrading a part without impacting the entire system.
- Detailed technical documentation for all system components.

### 6. Notifications

- Send instant email notifications when the status of requests or complaints changes.
- Guarantee 95%+ email notification delivery within 1 minute of triggering events.

### 7. Data Integrity

- Preventing data tampering through validation techniques for all user input.
- Saving copies of modified documents with the ability to revert to previous versions.

### 8. Accessibility

- High color contrast is available for people with visual impairments.
- The system can be used entirely via the keyboard (without a mouse).

### 9. Interoperability

- Provide RESTful APIs to seamlessly integrate the system with other systems.
- Supports export of reports in PDF, Excel, and CSV formats.

### 10. Security and Data Protection

- Encrypt sensitive data.
- Implement different levels of access and permissions for users.

### 11. Security and Data Protection

- The system should fully support Arabic, including right-to-left (RTL) interface display.

## 12. . System Compatibility and Deployment

- Ensure compatibility with major web browsers (Chrome, Firefox, Edge).
- The system must be deployable on a Windows Server and accessible via the web.

## 3.2 Functional Decomposition

Functional decomposition refers to the process of isolating separate computations, focusing on their functional differences, which operate independently. In contrast to data processing where the information is grouped together based on logic partitions. This approach provides a way to separate out any given problem and solve it in parts by distinct reasoning which allows it to be done in parallel without an excessive number of threads being spawned.

### 3.2.1 Actors

An actor in system analysis is an external entity that interacts with the system to achieve a specific goal; it can be a human user, an external system, or an automated device. The actor defines the roles and functions it needs from the system—such as sending or receiving data—and without the actor, the system cannot perform its tasks according to stakeholder requirements.

Table 3.1: Actors and their Job Descriptions

Actor	Roles
The Human Resources (HR) Officer	The Human Resources (HR) Officer is responsible for managing employee data and maintaining up-to-date administrative records. Their tasks include adding, updating, and deleting employee profiles, archiving HR-related documents such as employment contracts , and co-ordinating with other departments on administrative matters to ensure smooth and efficient operations.
Employee	Employee Employee: A regular internal user (municipality staff) performing daily tasks. Has limited permissions within their scope, such as uploading and archiving documents, viewing permitted documents, and sending/receiving internal communications within their authority.
Admin	The System Administrator (Admin) serves as the primary system manager with full control over its configuration and security settings. Their responsibilities include , monitoring user activity and login records, managing security settings and data backup procedures, and overseeing alerts and security reports to ensure the system operates reliably and securely.

### 3.2.2 Use Cases

Use cases are detailed descriptions of how external actors interact with the system to achieve specific goals. Each use case outlines the scenario starting from the actor's initial step—such as submitting a request or uploading a document—through the processing performed by the system, and concludes with a clear outcome. Use cases help clarify functional requirements, guide user-interface design, and form the basis for system testing to ensure all potential scenarios are covered.

Table 3.2: Use Cases Description

Use Case	Actors	Description
Login	HR, Employee,Admin	Login HR, Employee,Admin HR, Employee and Admin can log into their accounts.
Switch Languages	HR, Employee,Admin	HR, Employee and Admin can select and switch between supported languages in the app.
Send notification	HR, Employee,Admin	System sends appointment confirmations, reminders.
Upload Document	Employee, Admin	Upload digital files to the system and classify them appropriately.
Download Document	Employee, Admin	Employee and admin download archived documents
Change Document Status	Employee, Admin	Change status of a document (e.g., Under Review → Approved).
Search Archived Documents	Employee, Admin	Retrieve documents using filters like date, or tags.
Add	HR	Add user data
View	HR	View users
Update	HR	Update users data
Delete	HR	Delete users from the system
categorized	Employee,Admin,system	after upload the document system should select the why to search

Table 3.3: Login Use Case Description

<b>Login</b>	
<b>Actors</b>	HR, Employee, Admin
<b>Description</b>	All three users (HR, Employee, Admin) can log into their accounts.
<b>Pre-Conditions</b>	User must have valid credentials (username, password).
<b>Workflow</b>	<ol style="list-style-type: none"> <li>1. User enters login credentials.</li> <li>2. System validates credentials.</li> <li>3. If valid, the user is logged in.</li> </ol>
<b>Alternative Flow</b>	Invalid credentials: Show error message.
<b>Data</b>	Username, password
<b>Trigger</b>	User attempts to log in
<b>Post-Conditions</b>	User is successfully logged in.

Table 3.4: Search Archived Documents Use Case Description

<b>Search Archived Documents</b>	
<b>Actors</b>	Employee, Admin
<b>Description</b>	Retrieve documents using filters like date, or tags.
<b>Pre-Conditions</b>	User must be logged in.
<b>Workflow</b>	<ol style="list-style-type: none"> <li>1. User selects filters (date, tags).</li> <li>2. User submits the search.</li> <li>3. System retrieves documents based on filters.</li> <li>4. Display the results.</li> </ol>
<b>Alternative Flow</b>	Invalid filters: Show error message. No documents found: Show no results.
<b>Data</b>	Date, tags, document records
<b>Trigger</b>	User selects filters for search
<b>Post-Conditions</b>	Documents are displayed based on the filters.

Table 3.5: Upload Document Use Case

<b>Upload Document</b>	
<b>Actors</b>	Employee, Admin
<b>Description</b>	Upload digital files to the system and classify them appropriately.
<b>Pre-Conditions</b>	User must be logged in.
<b>Workflow</b>	<ol style="list-style-type: none"> <li>1. User selects document to upload.</li> <li>2. User chooses appropriate classification.</li> <li>3. Document is uploaded.</li> <li>4. System categorizes the document.</li> </ol>
<b>Alternative Flow</b>	File type or size invalid: Show error message. Document already exists: Show warning message.
<b>Data</b>	Document file, classification tags
<b>Trigger</b>	User selects a document to upload
<b>Post-Conditions</b>	Document is successfully uploaded and categorized.

Table 3.6: Change Document Status Use Case

<b>Change Document Status</b>	
<b>Actors</b>	Admin, Employee
<b>Description</b>	Change status of a document (e.g., Under Review → Approved).
<b>Pre-Conditions</b>	User must be logged in. Document must be uploaded.
<b>Workflow</b>	<ol style="list-style-type: none"> <li>1. Admin selects document.</li> <li>2. Admin selects new status.</li> <li>3. System updates document status.</li> <li>4. System shows confirmation.</li> </ol>
<b>Alternative Flow</b>	Invalid status transition: Show error message. Document not found: Show error message.
<b>Data</b>	Document ID, status
<b>Trigger</b>	Admin selects a document to update status
<b>Post-Conditions</b>	Document status is updated successfully.

### 3.2.3 Use Cases Diagram

A Use Case Diagram is a UML diagram that illustrates the primary interactions between actors and the system through use cases. It shows who interacts with the system (such as users or external systems), which functions or services the system provides to them, and the relationships among those use cases (including «include», «extend», and generalization). This diagram is used to visually capture the system's functional scope and identify its core requirements.

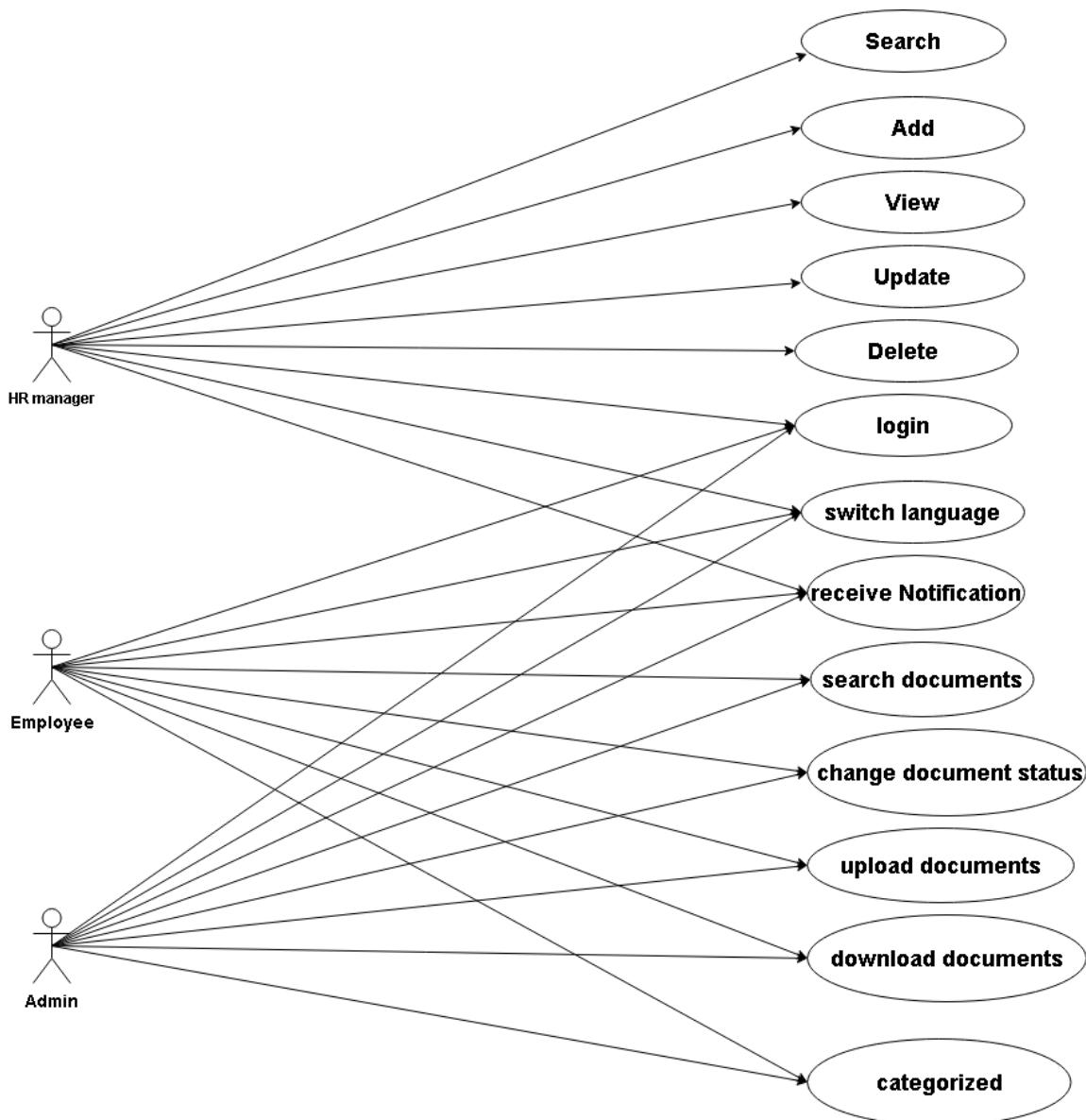


Figure 3.1: Use Case Diagram

## 3.3 System Models

System models are simplified representations of systems used to understand, analyze, and predict their behavior. These models can take various forms, including diagrams, mathematical equations, and simulations.

### 3.3.1 Class Diagram

A Class Diagram is a UML diagram that shows the system's main classes and their relationships. It lists each class's name, its attributes, and its methods, along with the types of relationships between them—such as aggregation, composition, generalization (inheritance), and dependency. Class diagrams are used to understand the system's static structure and to guide database design by illustrating how data are organized and how objects relate to one another.

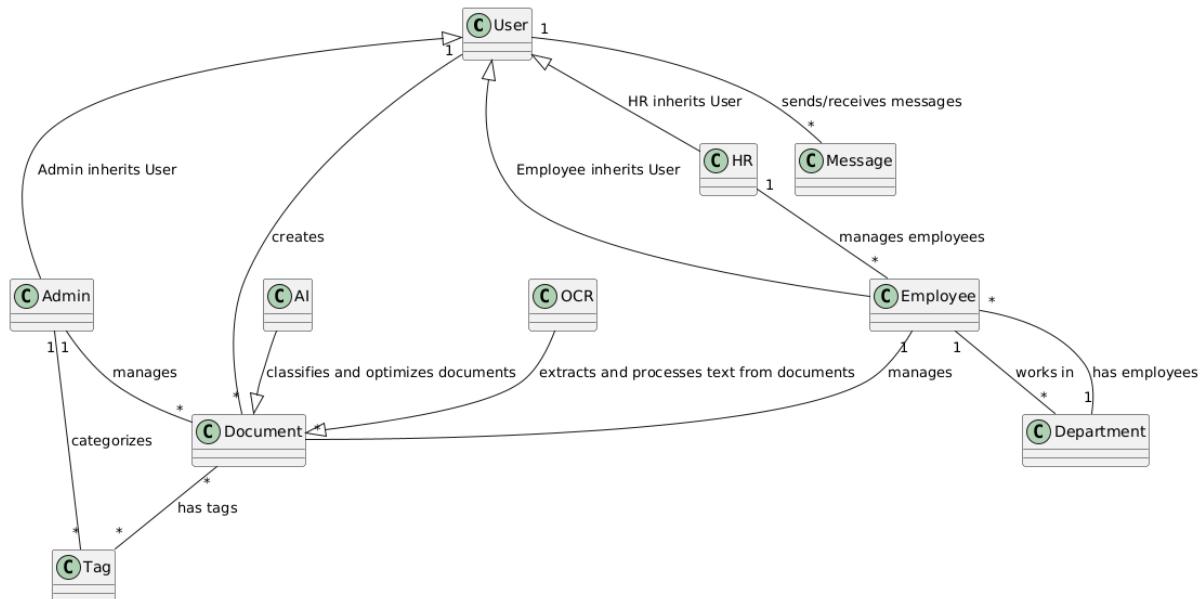


Figure 3.2: Class Diagram

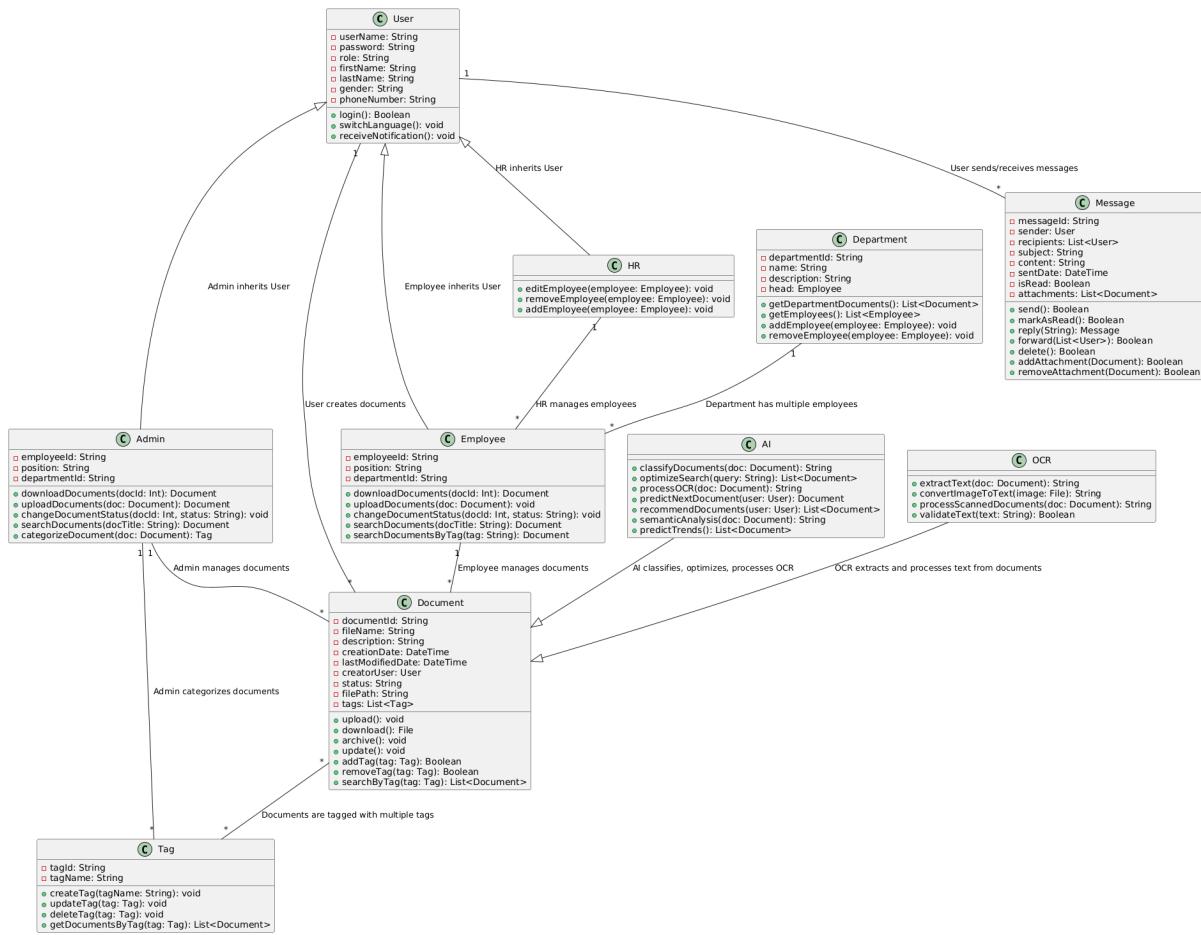


Figure 3.3: Detailed Class Diagram

### 3.3.2 Sequence Diagram

A Sequence Diagram is a UML diagram that illustrates interactions between actors and objects in the system over time. It shows lifelines for each object or actor and the messages exchanged between them, arranged chronologically from top to bottom. Sequence diagrams are used to depict execution scenarios, control flow, and data exchange among system components during a specific use case.

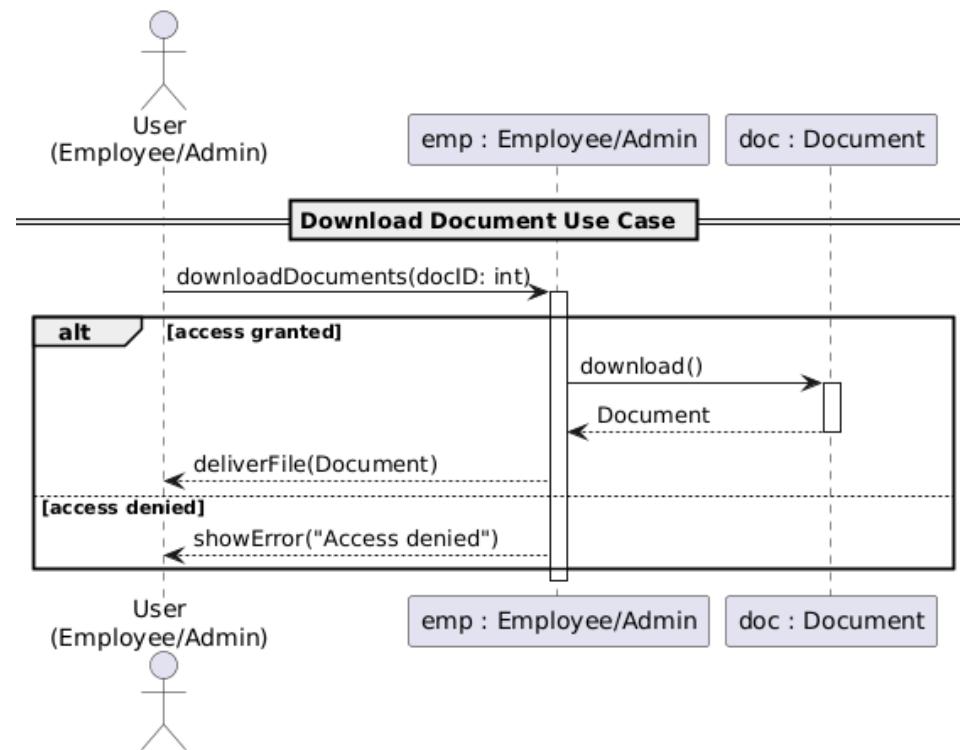


Figure 3.4: Download Document Use Case Sequence Diagram

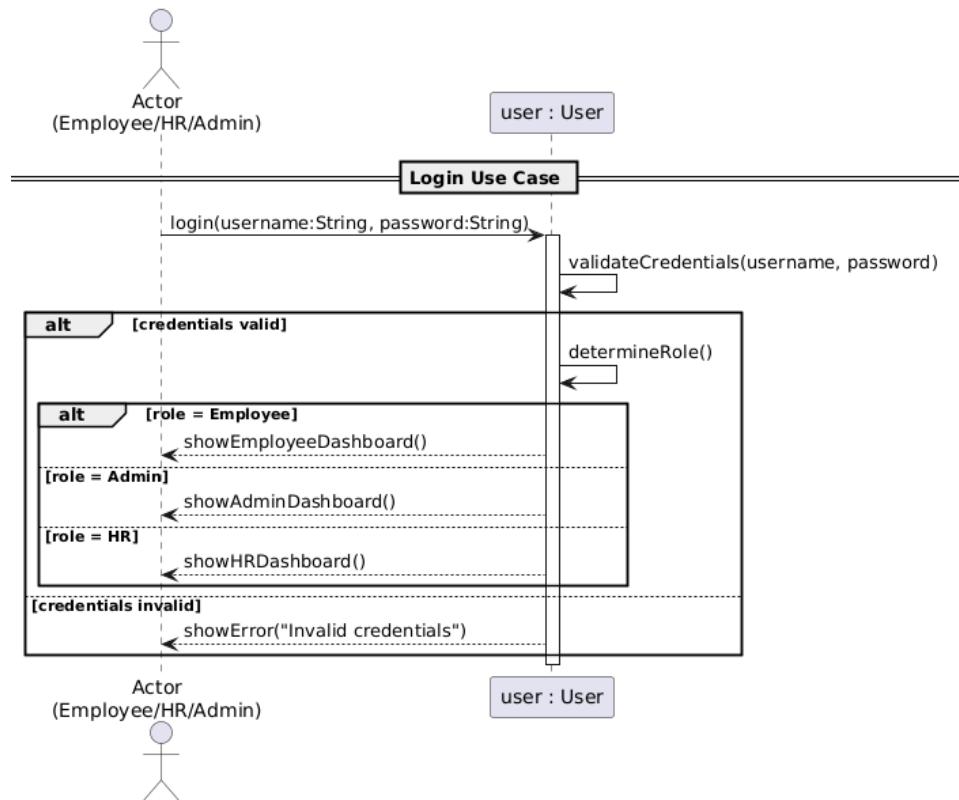


Figure 3.5: Login Use Case Sequence Diagram

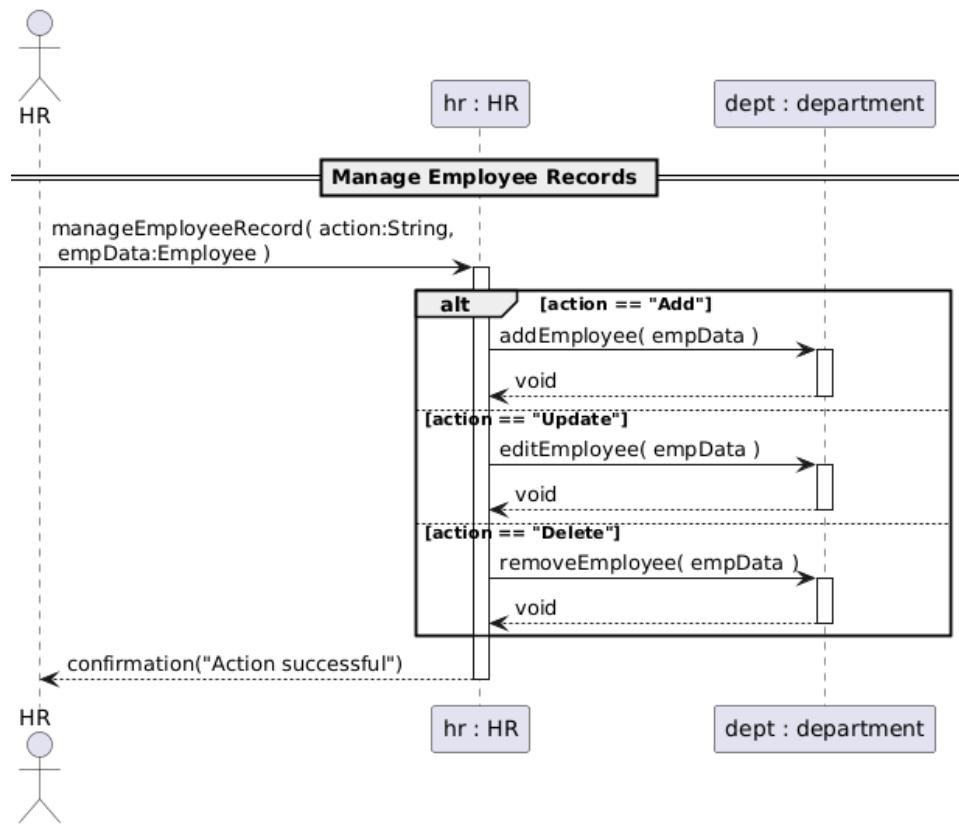


Figure 3.6: Manage Employee Records Use Case Sequence Diagram

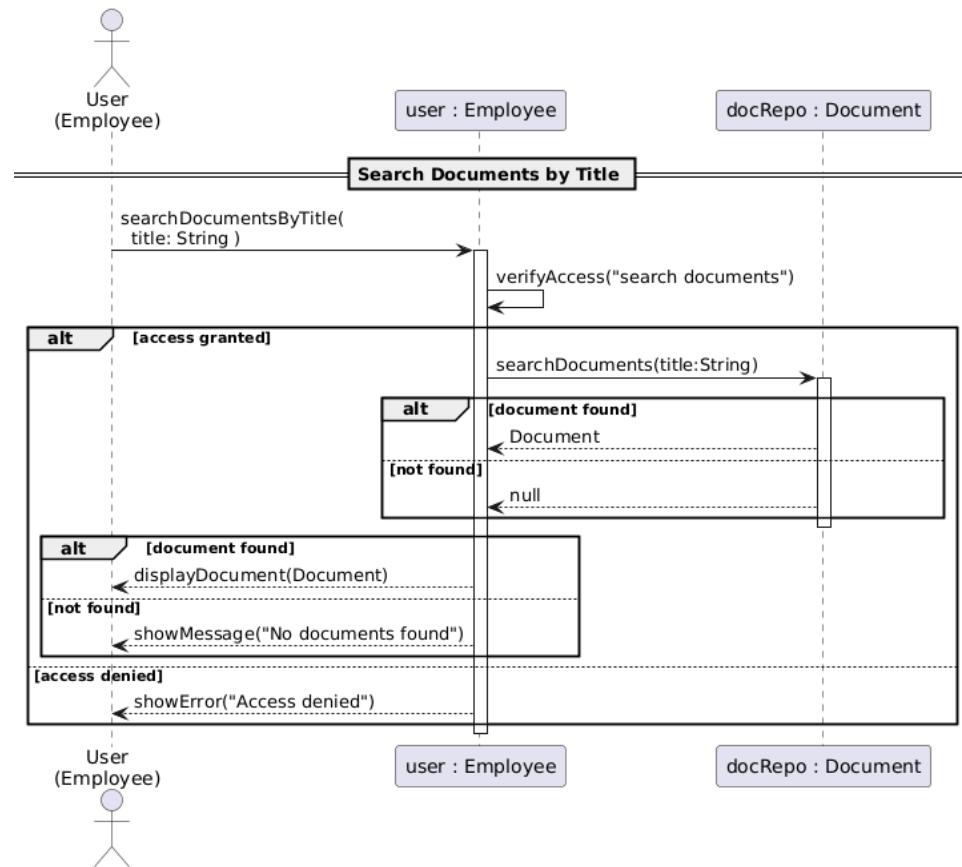


Figure 3.7: Search Archived Documents Use Case Sequence Diagram

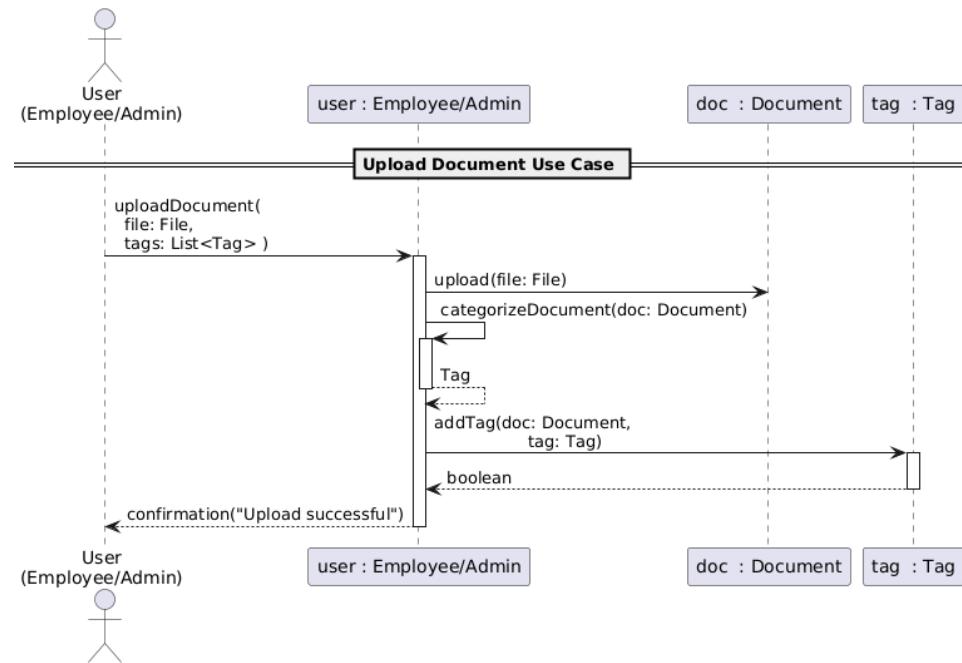


Figure 3.8: Upload Document Use Case Sequence Diagram

### 3.3.3 Activity Diagram

An Activity Diagram is a UML diagram that focuses on the workflow and processes within the system. It displays Activities and the Transitions between them, as well as Decision nodes, Merge nodes, Forks, and Joins to depict branching and synchronization in the execution flow.

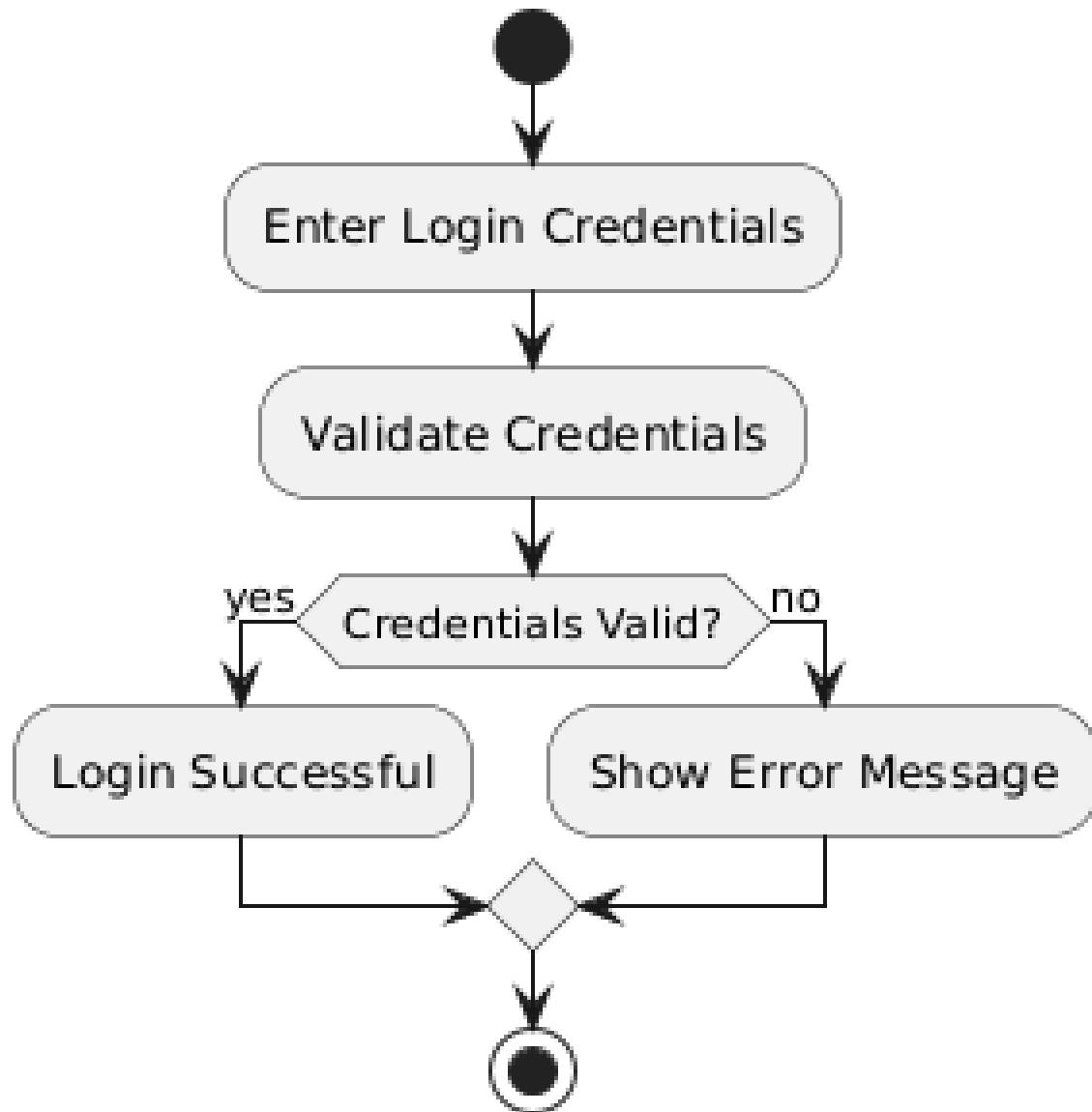


Figure 3.9: Login Activity Diagram

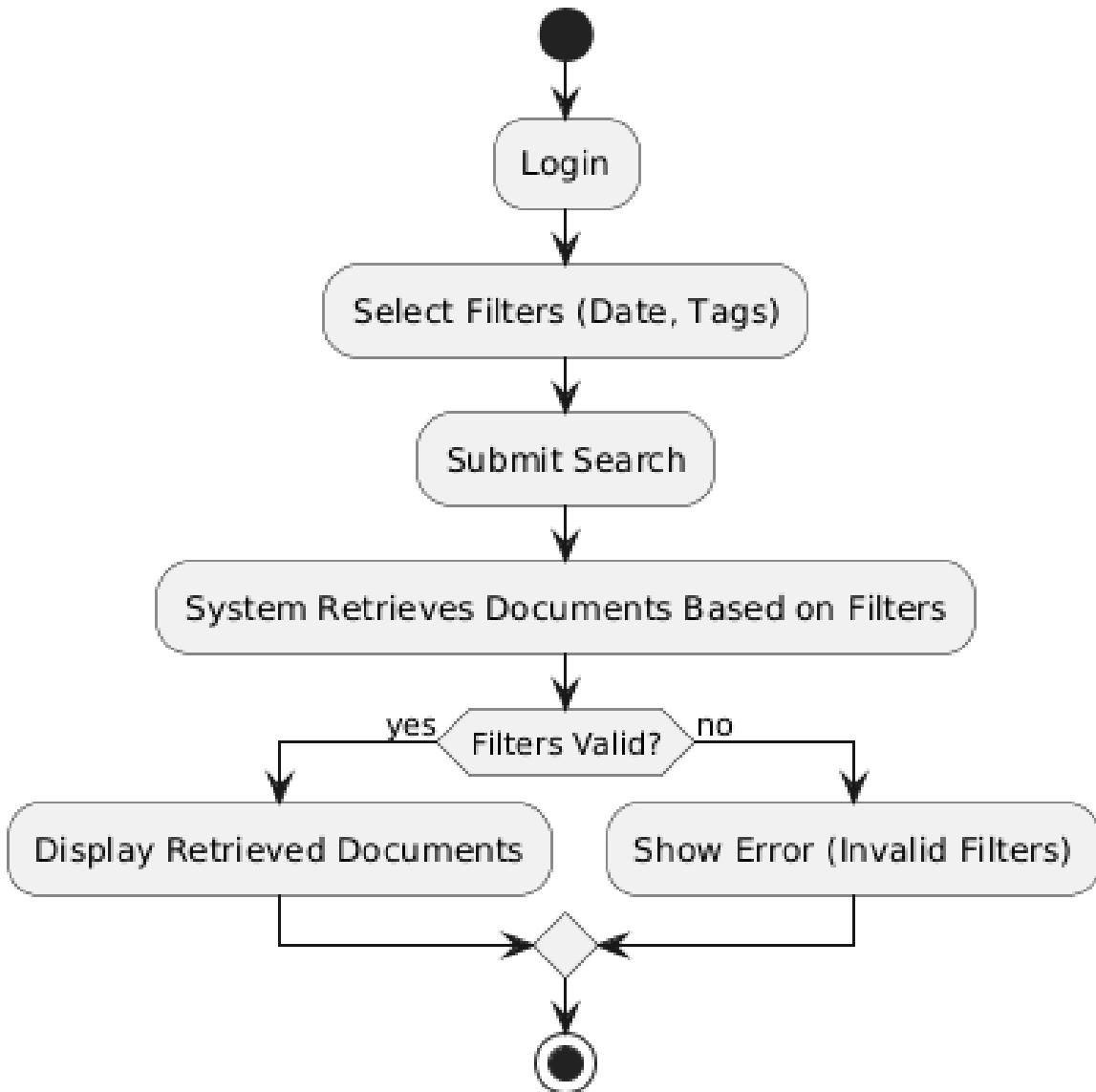


Figure 3.10: Search Archived Documents Activity Diagram

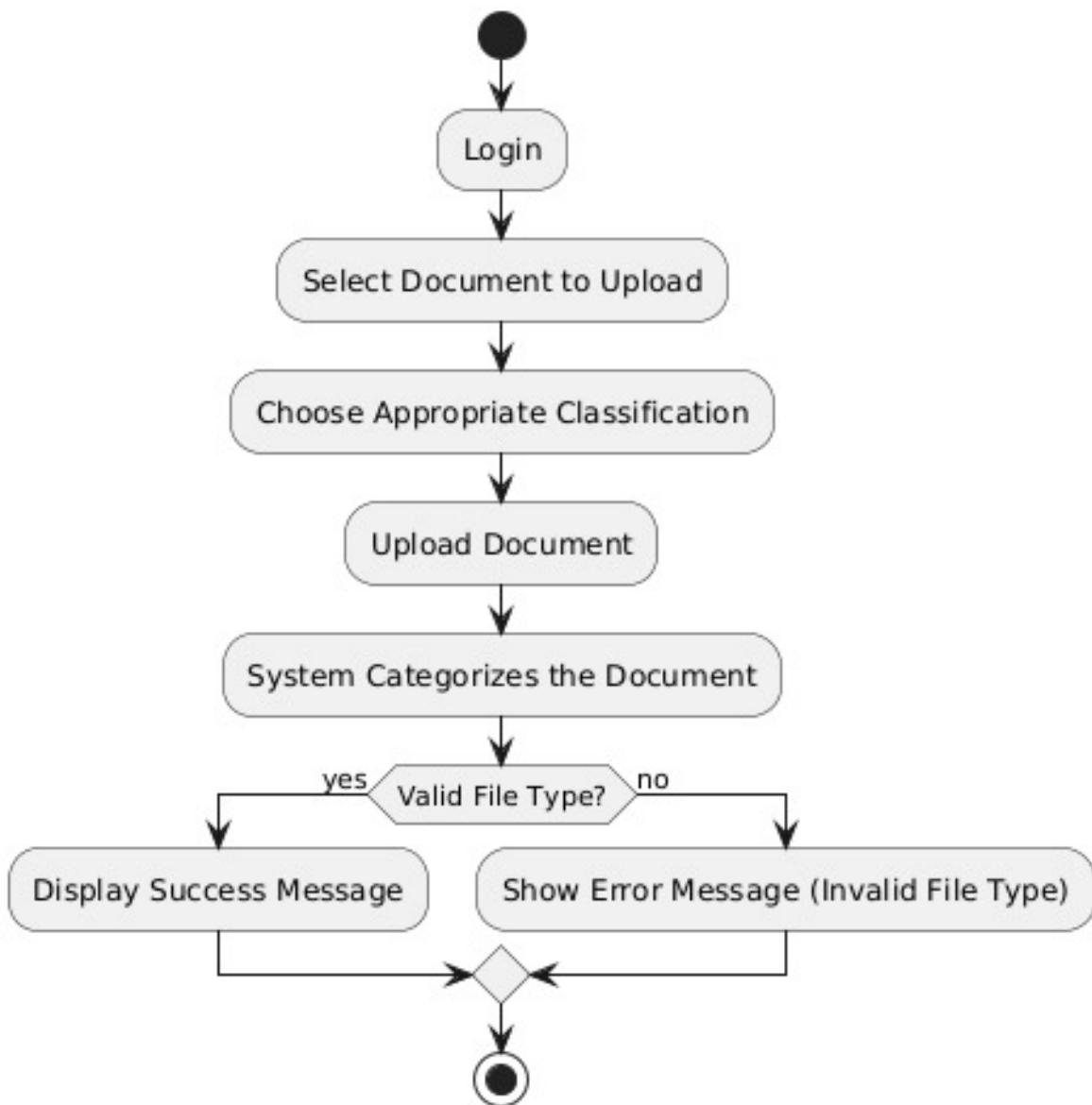


Figure 3.11: Upload Document Activity Diagram

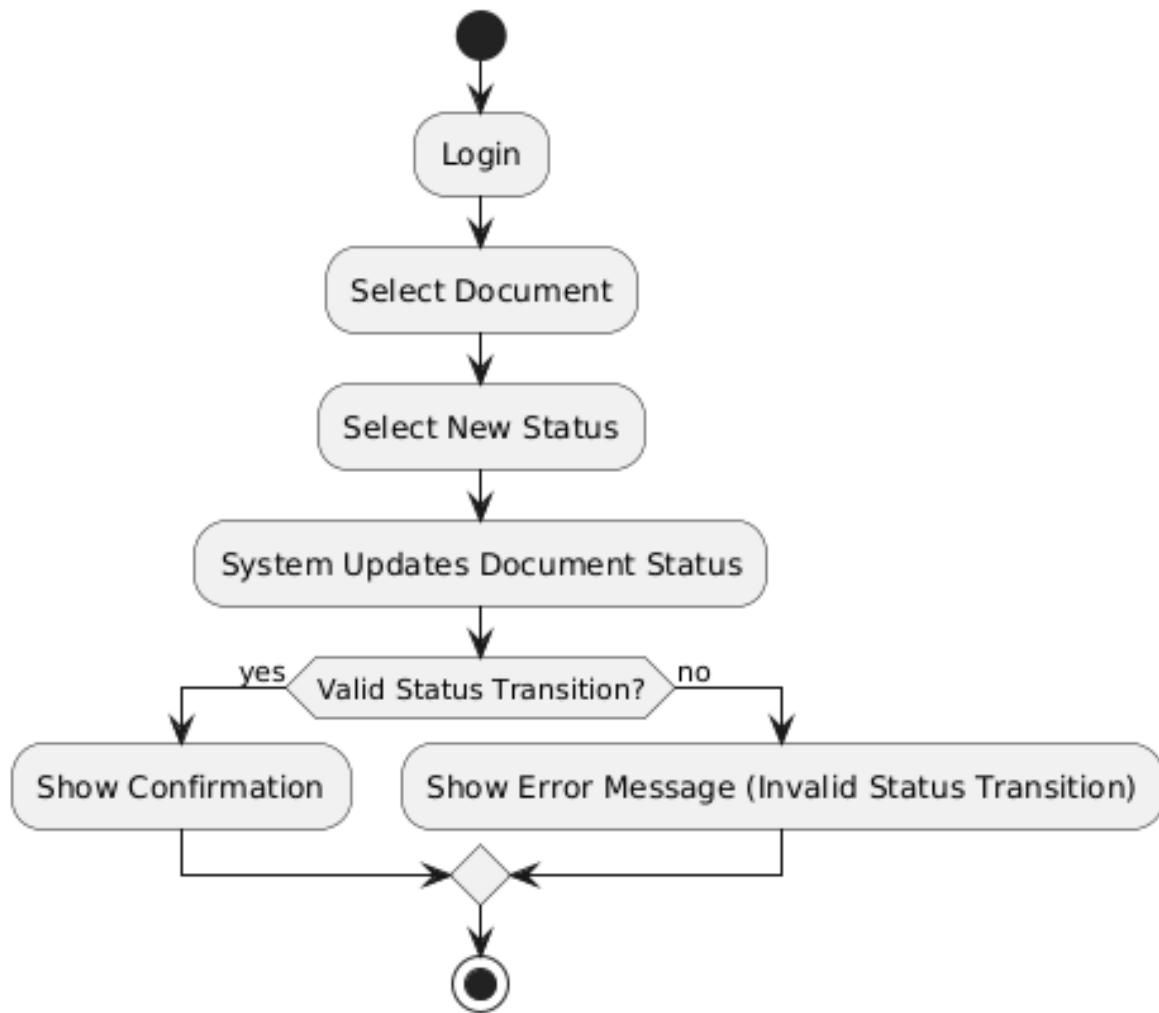


Figure 3.12: Change Document Status Activity Diagram

### 3.3.4 State Chart Diagram

A state diagram shows the stages an object or part of the system goes through and connects them with arrows that indicate the events causing transitions between those stages. This helps understand how the object's behavior changes over time.

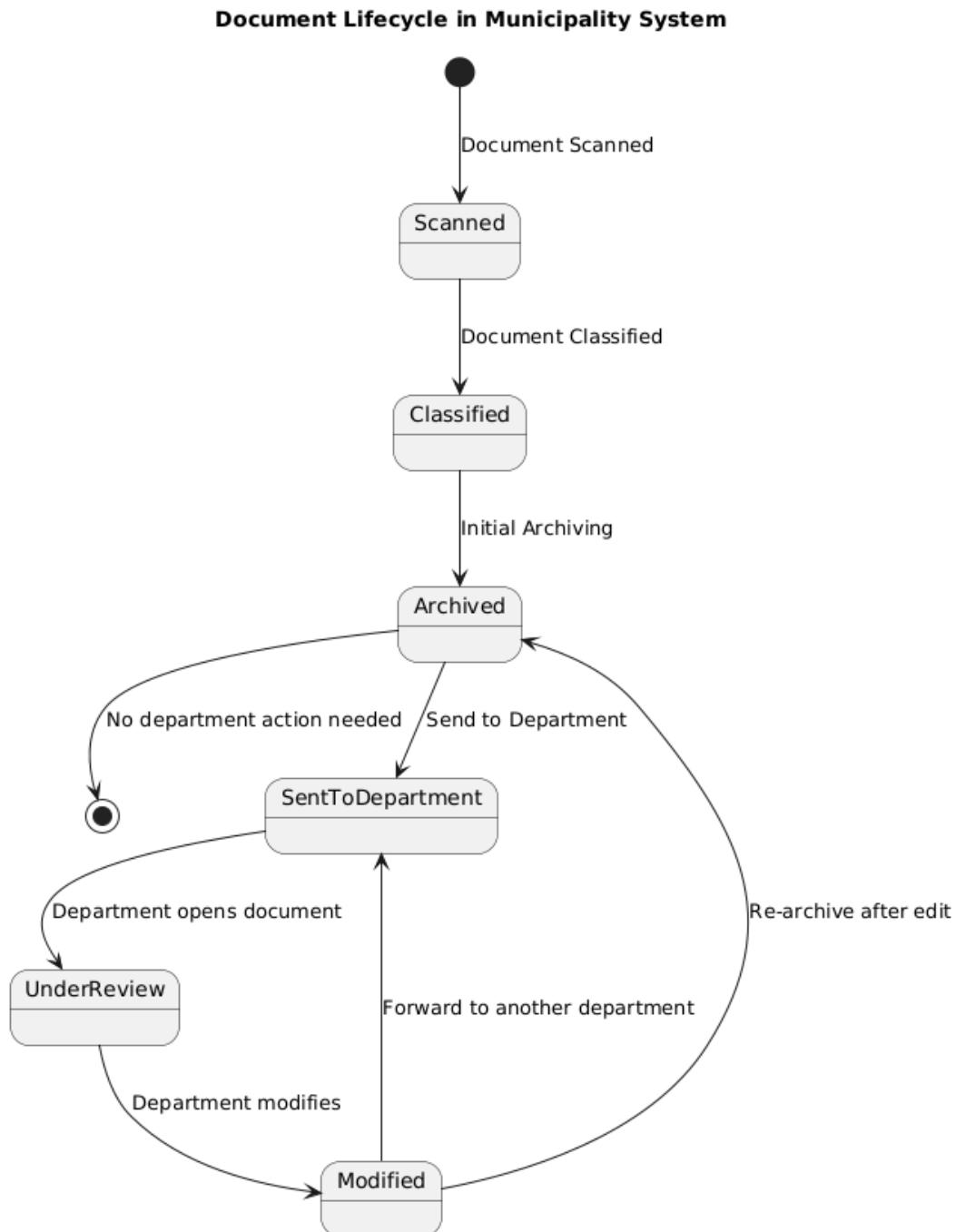


Figure 3.13: State Chart Diagram

## 3.4 System Architecture

System architecture refers to the conceptual model that defines the structure, behavior, and views of a system. It's a blueprint that outlines how different components of a system interact and work together to achieve specific goals. This includes both hardware and software components, system interfaces, and security considerations.

### 3.4.1 Software Architecture

Software architecture defines the overall structure and behavior of a software system, including its components, their relationships, and the principles governing their design and evolution. It's essentially the blueprint of a software system, establishing the fundamental organization and how its various parts interact. This high-level framework influences development speed, code quality, maintainability, and other critical aspects of the software's lifecycle.

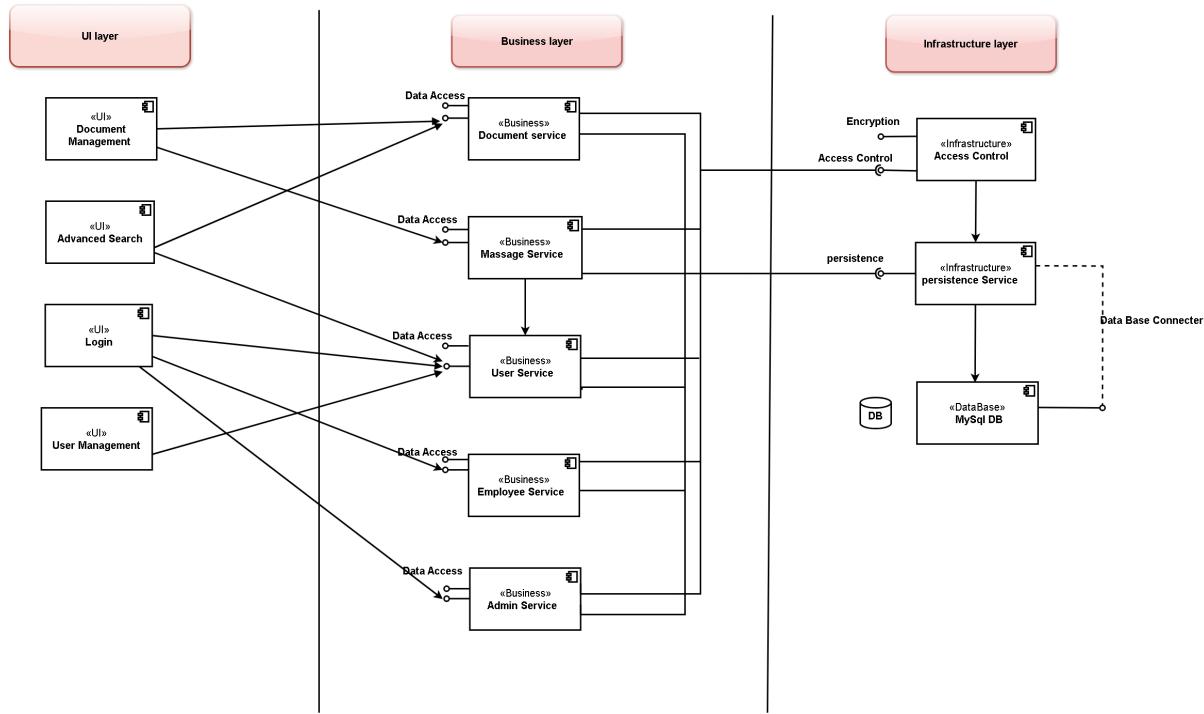


Figure 3.14: Software Architecture

### 3.4.2 Deployment diagram

A Deployment Diagram shows the configuration of runtime processing nodes and the software components deployed on them. It is a type of structure diagram in UML used to model the physical aspects of a system—such as the hardware topology and the distribution of software components—depicting the system's static deployment view.

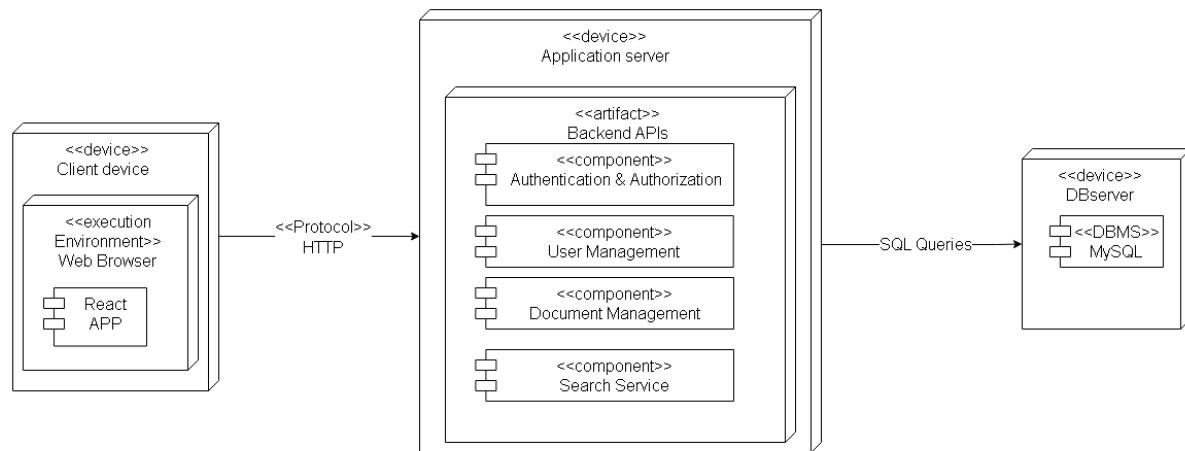


Figure 3.15: Deployment Diagram

### 3.5 Data Management and ERD

Data management defines how the system's information is organised, stored, accessed and maintained throughout its lifecycle. At its core is the Entity-Relationship Diagram (ERD), a conceptual model that depicts entities (tables), their attributes (fields) and the relationships (one-to-one, one-to-many, many-to-many) between them. By laying out entities, primary keys, foreign keys and cardinalities, the ERD guides the design of the relational database schema, ensures data integrity constraints are enforced, and serves as a blueprint for implementation and future maintenance.

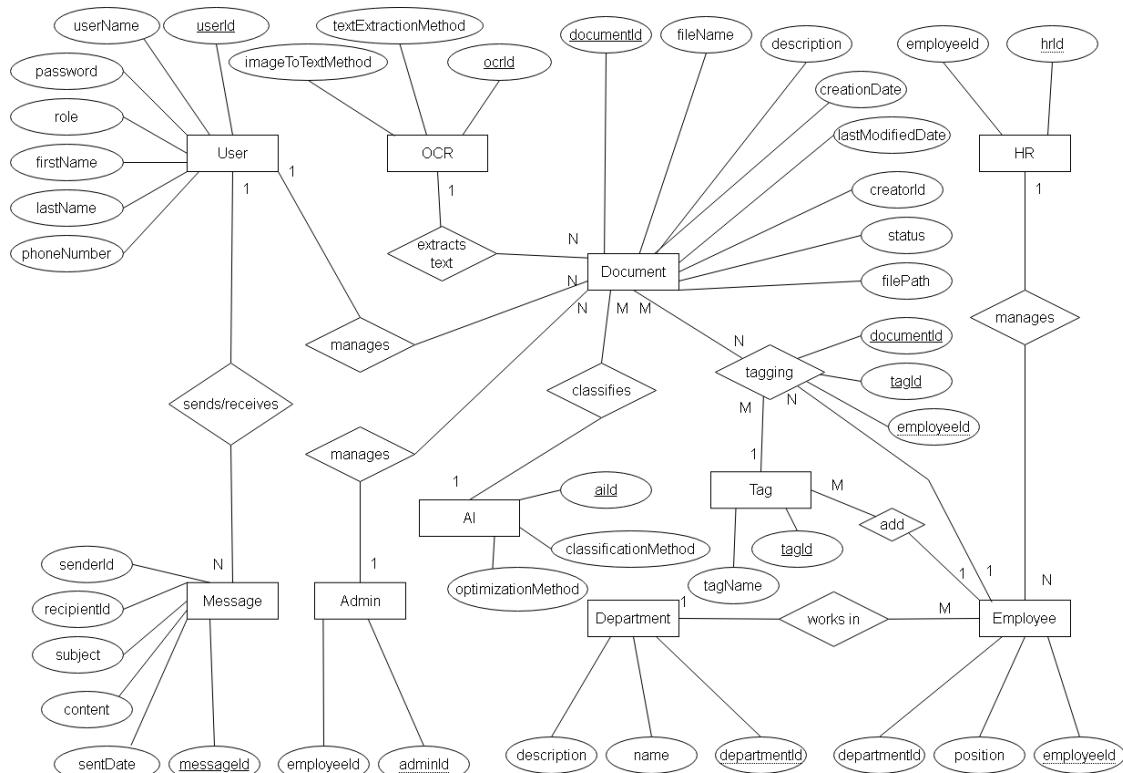


Figure 3.16: ER diagram

# Chapter 4

## Conclusion and Future Works

### 4.1 Review of the project

To date, the Birzeit Archive system has been fully specified and modelled to address the primary challenges faced by the municipality in managing internal communications and document archiving. The project's design outlines a digital platform for file sharing, classification, and secure access control, establishing a solid framework for future efficiency gains, reduced paper reliance, and greater transparency. Preliminary prototypes of key features—such as role-based dashboards, document categorization workflows, and advanced search filters—demonstrate a user-centred approach and promise an optimized workflow for employees and administrators. While full implementation, performance testing, and security validation remain to be carried out, the overall design already aligns with the project's objectives for usability, scalability, and compliance with municipal requirements.

### 4.2 Next Semester Plan

- **System Implementation:** Finalize front-end and back-end integration with full deployment on the intended server environment.
- **Testing and Debugging:** Execute functional, performance, and security testing to ensure the reliability of all features.
- **User Feedback Collection:** Pilot the system with selected municipal departments and collect feedback to refine the user interface and usability.

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