DESIGN AND DEVELOPMENT OF A WEB-BASED DATA MANAGEMENT SYSTEM FOR THE HUMAN RESOURCES DEPARTMENT OF PARAÑAQUE CITY COLLEGE

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Chapter 1

THE PROBLEM AND ITS SETTING

Introduction

Effective data management of both personal and professional information is crucial for organizations engaged in office management (Chinyere & Ikoromasoma, 2021; Emeh, 2024). The evolution of technology has transformed how data is being collected and stored, moving from traditional methods such as paper and pen, by using digital solutions including web-based platforms and software applications (Haleem et al. 2022) that allow individuals as well as organizations to handle information efficiently. In the study by Pansara (2023), effective data management plays an important role in improving decision-making by keeping data accurate, accessible, and current. Organizations that adopt advanced data management practices can ensure compliance, build trust, and provide effective communication between individuals.

However, there are still data management practices that rely on traditional approaches also known as manual processing. Some challenges related to storing, archiving, and retrieving of information include higher risk of human errors and increased time spent on administrative tasks therefore lowering productivity as discussed in the study of Kanyabwira (2024). Furthermore, Sumarni et al. (2020) argue that traditional methods using physical file storage for archiving are increasingly unreliable because these records are at risk to loss or damage. Organizations that rely on manual methods pose risks of data mismanagement in a rapidly evolving technological landscape. Without proper data management, the possibility of data breaches and unauthorized access to

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sensitive information can lead to legal problems, such as identity theft, financial losses and damage to an organization or personal reputation.

The factors mentioned above are not limited to corporate environment but are also common in other sectors including education. School institutions that depend on traditional methods may also encounter similar risks of data inaccuracies and potential data breach. Acebron et al. (2024), discuss that manual record-keeping of information remains common in the Philippines in everyday transactions. For example, in the Philippines manual methods remain common due to lack of infrastructure where there is unreliable internet connectivity, a lack of technological tools or technological initiatives in which manual methods more practical for people with limited access to these infrastructures (Celeste & Osias, 2024). These factors somewhat support the idea that manual methods remain a viable approach to data management. Similarly, in educational institutions, professors and administrative staff often follow traditional approach suggesting reliance on outdated systems. Enad & Balicoco (2023) discovered that schools encounter challenges in managing records, including ineffective manual record-keeping, issues with accessing data, and the potential for data loss because of insufficient backup protocols.

Parañaque City College (PCC), similar to other educational institutions in the Philippines, handles huge amounts of data related to faculty, staff, human resources or employment records. The existing records system currently employed in Parañaque City College heavily relies on documents such as hard copies stored using physical storage for archiving and retrieval. They use Microsoft Excel software or spreadsheet-based method for storing and organizing employment records. The reliance on physical documents may lead to issues such as limited accessibility, increased risk of loss or damage and difficulties in managing large volumes of data. Poon et al. (2024) finds that

while spreadsheet-based methods are effective for basic data organization, they are also susceptible to human errors due to their reliance on manual input. They also argued that as the amount of data continues to increase, relying on spreadsheets becomes less viable, leading to greater risks of data security issues and potential loss of vital information. Without an automated system, it complicates data manipulation and archiving, making it challenging to maintain up-to-date and access archive records. In line with these factors, this study highlights the importance of addressing these inefficiencies by developing and implementing modern data management system that can streamline processes, reduce errors and improve overall productivity.

Theoretical Framework
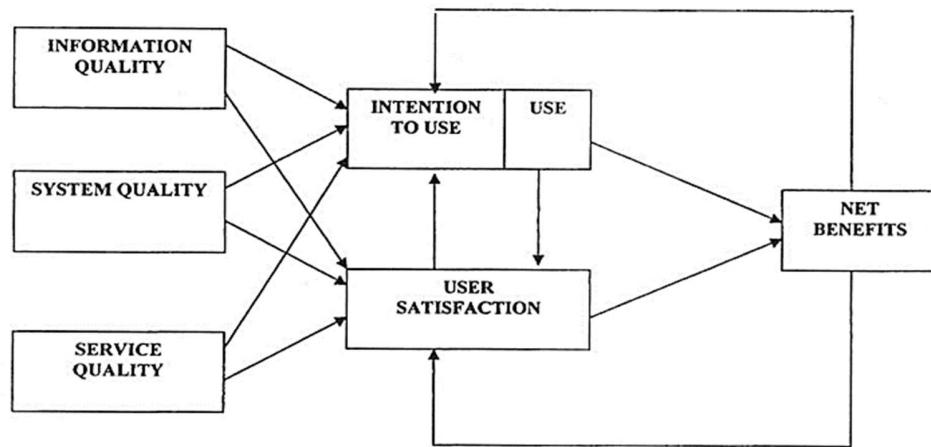
This study adopts the updated Information System Success Model (ISSM) theory created by DeLone and McLean published in 2003. Adeyemi & Issa (2020) utilized this model to demonstrate how it can guide information systems in addressing user needs and achieving organizational objectives effectively. Additionally, this model will identify areas for improvement ensuring that the system aligns with user satisfaction and expectations as well as organizational tasks.

The model is composed of 6 dimensions that address both the technical and behavioral aspects of the system: Information Quality, System Quality, Service Quality, Use, User Satisfaction, and Net Benefits.

Figure 1. DeLone and McLean Updated Model of Information Systems Success

In the context of this study, the model provided by DeLone and McLean can be defined in the following dimensions as follows;

Information Quality. The system's capability to ensure correct, relevant, and complete data is being presented to its users with respect to their role. Data should be easy to understand and is able to accept changes without issue.

System Quality. Referring to the system's overall effectiveness, measuring the degree to which it can perform its intended functions regardless of changing conditions. This includes, but is not limited to, its ability to maintain consistent performance as the number of requests or documents increases, its capacity to adapt to different screen sizes while preserving the proper display of information and functionality, and its reliability in performing correctly without data loss when users face network issues.

Service Quality. The level of interaction and support between HR and employees when using the system. This includes the availability to provide assistance when an issue

arises or when requesting resources from either party, such as forms or documents, where coordination between both parties is required.

Usage Intention. The perception of the developers, and the client on the system's intended purpose. This refers to the system's overall function from its appearance, user interaction, to its intended purpose to streamline HR and staff activities.

User Satisfaction. Refers to the user's perception of the system's intended purpose. It measures the system's capability to function as intended and how its functions streamline user activities. This includes the system's ease of use for different users, as well as how it aligns with their needs and expectations.

Net Benefits. The most important part of the model is where it answers questions regarding the system's overall performance. This aspect addresses all impacts of the system on the HR department of PCC and its staff, evaluating the system's level of operational effectiveness, employee satisfaction, and its contribution to better communication between HR and staff.
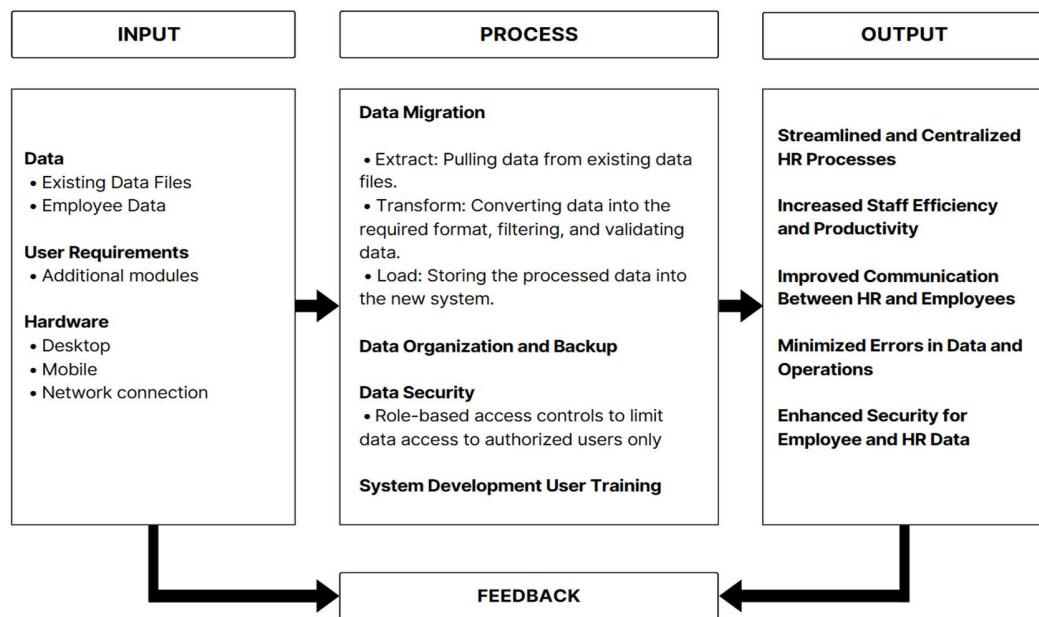
Conceptual Framework

The system process described in this conceptual framework highlights the input requirements, system features, and resulting outputs.

Figure 2. Input-Process-Output (IPO) Model

In Figure 2, shows the input-process-output (IPO) model to illustrate the steps of turning manual processes in PCC into a streamlined and digital system. The input stage discusses the required information needed for the development of the system, existing spreadsheets and other data files are required to identify data migration techniques, while employee data are needed to supply the necessary information in the employee registration module of the system. Additional modules can be added to the system based on user needs to improve functionality. Furthermore, the hardware aspect shows which platform the system is compatible with, given that the platform has a network connection.

In the process phase, data migration is made using existing data files through ETL (Extract, Transform, Load). The ETL process ensures that old data can be successfully migrated into the new system by extracting information from the legacy data storage, transforming it into a format compatible with the new system, and loading it into the new database. Data organization and categorization are also implemented to enhance data management by enabling HR users to filter and locate required data easily. User training is also being conducted to help users adapt to the new system.

Additionally, an iterative process of feedback collection with the client through ongoing communication is essential during the development of major parts of the system to ensure that it aligns with their needs and expectations. This process ensures that the developers receive relevant information and can quickly address any changes in requirements or preferences, allowing for the development of a tailored system.

With proper execution, HR processes lead to more efficient operations while also reducing human errors when entering or modifying data. Additionally, better data security is achieved using different security measures such as encryption and data export. The implementation of a system for HR members and employees facilitates better interaction and information exchange.

Statement of the Problem

The HR department in Parañaque City College (PCC) currently lacks an automated system for managing its Human Resources (HR) processes, which has led to challenges in handling employee documents. The absence of a centralized system forces PCC staff to manually process and update their employees' data such as employment history, educational attainment, as well as their personal information. In line with these

factors, it results in an added workload for HR Staff and making employee data susceptible to inaccuracies.

Additionally, the current situation in PCC does not effectively track, manage, or archive employee information across the entire employment lifecycle, from application through to resignation, retirement, or termination. HR personnel rely on storing data in Excel files, including but not limited to managing endorsement letters and memorandums in separate folders. This lack of automation and organized archiving further complicates the HR department's ability to locate the personal information of employees efficiently.

General Objective

To design, develop, and implement a web-based data management system for PCC, specifically for employees, to address data management issues and aims to enhance overall efficiency and security of HR-related information at PCC.

Specific Objectives

1. To gather information through repeated interviews or meetings with the HR department to identify current challenges, understand user needs, and define specific requirements for the system.

2. To design and develop a system based on the gathered information following the quality characteristics defined by ISO/IEC 25010 such as functionality, reliability, usability, efficiency, maintainability, portability, compatibility, and security.

3. To ensure data migration is carried out accurately and completely.

4. To test the developed system and identify any areas that require further revision.

5. To deploy the developed system within PCC grounds, specifically for the human resources department, and its staff.

6. To implement the system and evaluate its effectiveness by collecting user feedback through interviews and survey questionnaires.

Scope and Limitations of the Study

The study focuses on developing and implementing a data management system for the HR department of PCC. The system is designed to store and manage employee information allowing for filtering, retrieval, categorization, and organization of records. It transitions from spreadsheet-based methods to an automated approach for streamlining data management processes.

The system is specifically intended for HR employees, with access roles and permissions assigned by the Super Administrator. Users can perform actions and access features only within the scope of permissions granted to them. Additionally, it includes an information system for all employees where it allows them to view and manage their account-related information.

As a web-based platform, it is accessible online therefore it requires a stable internet connection able to support both desktop and mobile devices. This enables users to access the system from various locations for better scalability and usability. The portal also provides several features, such as downloading files, submitting requests for official business and offset forms, updating personal information, and accessing submitted files. Access to the system, however, is restricted to PCC employees with existing records in the database and valid login credentials.

This study limited its scope through the following:

The system does not support multiple languages; whereas English is the only available language. Employees, particularly those in a diverse workforce who are not proficient in English, may find navigating the system challenging. This limitation could lead to potential risks, such as errors in data entry and reduced efficiency in using the system's features.

The system is solely for use by the HR department and does not support other existing departments or offices within PCC, such as the registrar office. This means that while HR can fully utilize the system's features, other departments will not have access to the same tools and capabilities provided in the proposed system. As a result, other departments may need to rely on separate systems to manage their data and tasks. This limitation can lead to lack of integration within PCC restricting them to share information and collaborate effectively.

The system cannot migrate 201 files types directly into the system. However, it provides functionality for importing and exporting data in Excel file formats, allowing users to manage and transfer information using spreadsheets.

Furthermore, the system does not incorporate predictive analysis tools, which are valuable for analyzing trends such as employee performance, absenteeism, and potential turnover risk or employees looking for other opportunities. The absence of this feature means that the system can only offer access to historical and current data of employees.

Significance of Study

The results and findings of this study will be beneficial to the HR Manager, HR Staff and Officers, College Administrator, Employees and Future Researchers in the following aspects:

To HR Head. This study will benefit their work by streamlining the organization of employee personal details, making the human resources processes more efficient.

To the HR Staff and Officers. This study will be significantly beneficial to their work especially in archiving or updating employee records improving efficiency and accuracy.

To the College Administrator. This study will benefit the college administrator as the system will provide oversight of centralized employee data.

To the Employees. This study will be beneficial for the employees to update and monitor their personal details as well as their submitted documents through the system for ease of accessibility.

To the Future Researchers. This study will serve as a foundation for future researchers who wish to explore a similar topic, giving them insights related to automation of data management practices.

Definition of Terms

This section provides definitions for the following terms:

Application Programming Interface (API). It is a set of rules, protocols, and tools that allow different software applications to communicate with each other.

Cascading Stylesheet (CSS). It is a stylesheet language used to define the presentation and formatting of a document written in HTML or XML.

Data Migration. Involves a process of selecting, preparing, extracting, transforming and transferring data from one system to another.

Database. It is an organized collection of information, typically stored electronically, that allows for efficient retrieval, management, and manipulation of data.

Encryption. Encryption is a method of changing information into a secret code to keep it safe from unauthorized access, ensuring that only people with the correct key can read it.

Extract, Transform, Load (ETL). It is a data integration process that involves extracting data from various sources, transforming it into a suitable format, and loading it into a target system for analysis or use.

Information Systems (IS). Refers to the combination of technology, people, and processes used to collect, store, process, and distribute data.

International for Standardization Organization (ISO) and the International Electrotechnical Commission (IEC) 25010. The ISO/IEC 25010 is an international standard that defines a model for evaluating the quality of software systems addressing key quality characteristics including functionality, reliability, usability, efficiency, maintainability, portability, compatibility, and security, providing a framework for assessing the performance and effectiveness of a software system.

Microsoft Excel (MS Excel). A spreadsheet software developed by Microsoft Inc. used for organizing, analyzing, and visualizing data by using formulas, charts, and tables.

Module. It refers to parts of a larger system, each performing a specific task or function. They help in organizing complex systems making it easier to build, test, and manage the system.

Parañaque City College (PCC). A local government-run higher education institution in the City of Parañaque that provides accessible and quality education to the local community.

Relational Database Management System (RDBMS). It is a type of database management system that stores and manages data in a structured format using tables.

Single-page Application (SPA). A type of web application or website that dynamically loads content typically using HTML to present information to users to users.

Supabase. An open-source backend-as-a-service (BaaS) platform that provides developers with features like authentication, database management, and real-time APIs to build web and mobile applications efficiently.

User Interface (UI). Refers to the medium of interaction between a user and a system, application, or device.

Web-Based System. A software application or solution that can be accessed and operated through a web browser over the internet rather than being installed on a local computer or device.

Chapter 2

REVIEW OF LITERATURE AND STUDIES

Technical Background

The integration of modern technologies capable of scaling, and maintaining flexibility, and allows the efficient use of resources to provide smooth user experience must be robust enough to handle data management tasks while being adaptable to future additions to the system. The chosen technology stack includes frontend and backend technologies, along with testing tools used during the system's development.

The system utilizes a RESTful API to retrieve or insert data, rather than relying on other methods such as direct database queries. Moreover, this allows client-server communication to be stateless where no information from the client is stored between each request providing enhanced data security (Red Hat, 2020). In an article by Shubel (2022), TypeScript was defined as a superset of JavaScript, designed to allow type declaration of variables. While TypeScript is transpiled into JavaScript at runtime, it helps developers catch potential type errors during the development phase of the system.

React was used as the main library for building the system's user interface (UI), due to its ability to create single-page applications (SPA) where only one webpage is loaded but is modified through JavaScript. By integrating SPA model using React significantly improved the responsiveness while reducing loading times as have proven in the study of Jonathan & Suprihadi (2023), implementing SPA can optimize web applications for both performance and user experience. Moreover, React enable developers to create reusable UI components which simplifies the development process and ensures consistency across the application (GeeksforGeeks, 2024).

In addition to front-end development, Tailwind CSS is a utility-first CSS framework that allows styling HTML elements by directly inserting Tailwind classes, rather than writing custom CSS in a separate stylesheet file, as noted by Budiman (2023). This approach is particularly well-suited to React due to its ability to create reusable components, allowing developers to apply consistent styling quickly.

On the server side, Node.js was utilized as an open-source runtime environment for JavaScript, which traditionally runs only in the browser. By enabling JavaScript to be executed on both frontend and backend, Node.js facilitates full-stack development using a single language across the entire system (Rachowicz, 2024). The researchers stated that Node.js primarily serves as the Application Programming Interface (API), acting as a bridge between the frontend and backend allowing for easy data exchange with the database.

In the context of database particularly Supabase, it simplifies backend development (Ayezabu, 2022) including a database, authentication system, and file storage. The Supabase Database is built on PostgreSQL – a powerful relational database management system that allows developers to manage and store data efficiently, supporting complex relationships, and real-time updates (Ayezabu, 2022; Okanda et al. 2024). With Supabase, developers can easily set up tables, manage schema changes, and perform database queries via SQL or API calls. The platform also includes Supabase Auth, a user authentication system that supports various sign-in methods (Manohar et al. 2024), including email/password authentication and social logins like Google and GitHub. It handles important features such as password recovery, session management, and email verification, allowing developers to implement secure authentication without building a custom system (Manohar et al. 2024; Okanda et al. 2024). Additionally, Supabase Storage

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provides a file management service where developers can store and organize files in "buckets" These buckets allow for secure file storage with customizable access controls, supporting both private and public file sharing (Ayezabu, 2022). According to Supabase's official website, Supabase Storage offers an easy-to-use API for uploading, downloading, and managing files, making it an ideal solution for applications that require user-generated content or other media storage. These services make Supabase a backend solution in streamlining the process of building a secure and data-driven application.

Challenges of Manual Processes in Human Resource Management

Manual processes specifically in HR management may have challenges that affect both organizational efficiency and data accuracy. The traditional methods, such as paper-based record-keeping and manual data entry, commonly have inefficiencies such as slow data retrieval, higher error rates, and increased administrative workload. Studies shows that relying on manual processes in HR can reduce productivity and create significant risks, including data loss and increased security vulnerabilities.

In the study of Jayoma et al. (2020), manual storage of documents damages the records and is prone to human error. This manual approach is not only time-consuming but also slows down document retrieval and management. The constant handling of large volumes of documents increases the chance of mistakes and reduces efficiency. Furthermore, the Department of Social Welfare and Development (DSWD) office in Caraga Region, Philippines as a primary government with mandate in social protection and poverty-reduction, handles a large amount of data as they generate records daily (Jayoma et al. 2020). Based on the findings in the study, it was revealed that the DSWD office frequently uses manual methods in terms of written and printed forms in maintaining

customer profiles and records such as BIR, SSS, PhilHealth, and Pag-IBIG are among primary records that contain sensitive information of an individual. These types of records are stored manually upon registration and retrieved by employees as needed for data gathering or updates. As noted by Jayoma et al. (2020), these records are predominantly managed using manual methods, with data stored in written and printed forms during registration. Employees must manually retrieve, update, or track records, particularly during data-gathering activities or client updates. Due to the absence of a software application for tracking records, adding, updating, and monitoring each client's details is a manual process (Tumasis, 2022; Jayoma et al. 2020). Without a centralized system for tracking, updating, and monitoring client information, employees rely heavily on traditional methods, which are labor-intensive and prone to delays. Furthermore, the absence of digital solutions not only limits operational efficiency but also presents the risk of errors and the integrity of sensitive data (Tumasis, 2022).

Similarly, in the context of school institutions, a study of Cuevas & Casauay (2022), developed a document archival system for Sto. Niño High School in Cagayan, Philippines and they identified one of the tasks involves that staff manually archiving 201 files that contain employees' sensitive information. These files include personal details, employment, financial history, employees' contract, job performance grade as well as their unique identification numbers such as tax identification number and social security number. They also identified file loss due to unsecured storage as a major issue, compromising the confidentiality and reliability of sensitive employee records. They also found that manual processes for retrieving and updating these records are time-consuming and prone to errors, leading to inefficiencies in school operations. These documents are usually hard copies and stored in cabinets and folders, have led to issues

such as file loss due to unsecured storage therefore these challenges in retrieving and updating records become unreliable especially on organizational setting (Cuevas & Casauay, 2022).

User Adaptation to Data Management System

Introducing a new system to users who have limited to no-experience with digital systems involves a process known as "user adaptation." When transitioning to a data management system, new users must adapt to a new system not only the technical skills but also the flow and functionality of the system. According to Halid et al. (2023), the shift towards digitalization creates pressure to adapt, requiring HR managers to acquire new competencies and adopt more flexible working methods. To address this, it is essential to ensure that users can transition smoothly and fully adapt to the new system. Some effective strategies, including system training, support, and user engagement, are essential to facilitate this adaptation and help users integrate the new system into their daily routines specifically for administrative tasks in human resources.

In the Philippine setting, the study by Acebron et al. (2024) observed that the implementation of a digital archiving system in a local provincial government in Laguna was positively received by its users, who acknowledged its benefits in sustainability, security, and operational efficiency. The findings highlight the importance of user awareness in maximizing the effectiveness of digital systems therefore showing the need for further training and support to enhance users' understanding of the system's capabilities.

However, as per Sutrisno (2023), when an organization adopts new technology, some employees may not readily accept the change. Some may worry about losing their

jobs or their skills becoming outdated. Therefore, it is crucial for the HR team to clearly communicate the benefits of these changes and provide sufficient training to help overcome this resistance.

Additionally, a study conducted by Arifin et al. (2022) developed a web-based personnel information system for a university in Indonesia and found that users reported an easy transition from a manual to a web-based system. This transition improves staffing processes resulting in a reduction of the time and effort previously required for these tasks. Moreover, it was revealed that employee and administrative staff found the system to be user-friendly, accurate, and well-formatted, contributing to an overall positive user experience.

Effectiveness of Implementing a Data Management System

The implementation of an HR information system (HRIS) aims to provide a structured and secure environment for storing employee documents. According to Berdin et al. (2022), shifting from manual methods to an electronic data management system is a crucial step towards digital transformation. This transition not only allows employees and authorized personnel to organize and access their documents efficiently but also ensures that their information remains accessible when needed. Studies suggest that by replacing paper and spreadsheet-based methods with an automated system, organizations can streamline their internal processes, minimize errors, and improve the overall accessibility of important data (Alojail & Khan, 2023). The system supports faster data retrieval by enabling easier tracking, organizing, and managing employee information.

Mukherjee and Mukherjee (2022) highlight that the transition from manual to digital platforms in HR processes has made managing employee records more efficient and

secure. With advancements in technology, organizations can automate routine HR tasks, provide employees with secure access to their personal data, and ensure the accuracy and confidentiality of sensitive information. Digital record-keeping has addressed common issues associated with manual processes, such as errors, inefficiencies, and data mismanagement, by centralizing and safeguarding employee information.

Additionally, Abuhantash (2023) highlighted that developing a centralized HRIS significantly enhances organizational effectiveness by aligning HR practices with company objectives. Their research found that automating routine data-related tasks through an automated system helps reduce errors and administrative workloads, leading to more accurate data handling and more timely decision-making. The study also discussed that by reducing repetitive manual tasks, a data management system allows HR personnel to focus on strategic initiatives rather than spending time on routine data management.

Moreover, Abidovna (2024) emphasized that implementing an HRIS enhances the effectiveness of HR processes, particularly through the integration of advanced information technology. This system not only improves the accuracy of employee data management but also streamlines the generation and processing of various HR reports. Through this automation, HR departments can operate more efficiently, reduce time spent on administrative tasks, and increase productivity across the board.

Enhancing Data and System Security in Web-Based Applications

As mentioned in the works of Cremer et al. (2022) and the article published by McAfee (2020), findings discussed that in 2020 alone, cybercrime impacted the global economy, costing nearly USD 1 trillion with a 50% increase since 2018. This highlights how crucial it is to have strong data security, especially as more applications become

available or transitioned to the internet. Applications that are accessible on the internet have become a significant concern in the context of data privacy as their usage grows (Nishnianidze, 2024). The protection of sensitive information from unauthorized access, breaches, and cyberattacks is essential to maintaining trust and integrity. In the context of securing data and systems through web-based applications involves using protective measures like encryption and authentication. As noted by Li & Liu (2021) that these steps help protect against threats that could harm data or the system. The same measures taken in the study of Mohammed et al. (2020) they stated that a system relying on encryption acts as a protective barrier, ensuring that personal or other confidential information remains secure from unauthorized access during storage and transmission across networks.

In the context of data encryption, based on the study by Li & Liu (2021), data encryption turns sensitive information into a coded format, keeping it secure from unauthorized access. Research shows that encryption can maintain high efficiency over 95% while providing strong security. The study also shows that effective encryption within systems includes components for managing keys and protecting data. Based on the findings, Key Management is responsible for the creation, distribution, and lifecycle of encryption keys, ensuring that they are securely handled throughout their use. The Key Engine performs the core function of encryption and decryption, applying these keys to protect and access data. Proper management of these components is crucial for maintaining strong data protection, as it ensures that data remains confidential and secure against unauthorized access (Ali & Arsalan, 2024; Li & Liu, 2021) and integrating these components within a system will enhance overall system reliability.

The advancements within the internet in recent decades allow the exchanging of personal data to instantly reach other users as data is transmitted across various platforms, particularly on the Internet, security issues continue to escalate (Sakan et al. 2022). On the other hand, in the context of protecting data and system, another essential technique in modern data security is by implementing hash algorithms. This process is designed to convert input data, regardless of its size, into a fixed-size string of characters known as a hash value. This process takes any amount of data input and transforms it into a unique string of characters. Moreover, the hash algorithm will take a lengthy document and convert it into a short, fixed-size code. In the proposed study of Mohammed et al. (2020), they asserted that one of the main properties of hash algorithms is "one-way" function. This means that once data has been converted into a hash value, it is nearly impossible to reverse the process and retrieve the original data. This characteristic is essential for protecting information from unauthorized access. Hash algorithms ensure that sensitive data remains secure by making it difficult for attackers to reconstruct the original information from the hash value (Alojail & Khan, 2022).

Another method of enhancing data security is salting. It is a random value added to data before hashing to improve security (Aarju and Kaur, 2023). It ensures that even if two pieces of data are the same, their hashed outputs will be different. This prevents attackers from cracking passwords. Using salt, each hash becomes unique, making it harder for attackers to guess or reverse-engineer passwords. The study of Aarju & Kaur (2023), explained that, unlike traditional encryption methods, the approach with the inclusion of salt emerges as a solution to strengthen data security. They noted that, by adding randomness and complexity to encryption, this method enhances resilience

against brute-force attacks and other security threats, therefore ensuring the confidentiality and integrity of data during transmission and storage.

As the demand for web-based applications continues to grow, the need to secure data and systems has become increasingly critical (Li & Liu, 2021). According to Admass et al. (2024), one of the most important aspects of building secure web applications is ensuring that both the data being stored and the systems managing it are protected from unauthorized access, data breaches, and other security threats. Supabase provides integrated solutions that help developers implement security measures within their applications (Omotunde & Ahmed, 2023). These security practices are vital to safeguarding sensitive user information and ensuring that web applications comply with industry standards (Li & Liu, 2021; Aarju & Kaur, 2023; Admass et al., 2024).

One key component in enhancing security is the database. According to Li & Liu (2021), a well-structured and secure database is essential for managing data efficiently while protecting it from unauthorized access. Supabase, for example, uses PostgreSQL, which is known for its security features, such as encryption, authentication, and access control mechanisms (Ayezabu, 2022). These features help protect data at rest and in transit, ensuring that only authorized users and systems can interact with the database. PostgreSQL also supports role-based access control (RBAC), which enables developers to assign specific permissions to users and limit access to sensitive data. As noted by Omotunde & Ahmed (2023), this ensures that only authorized personnel can access, modify, or delete records, thereby minimizing the risk of data breaches.

Another important aspect of web application security is authentication. According to Ayezabu (2022), effective user authentication systems are critical in ensuring only authorized individuals have access to sensitive data and resources. Supabase Auth has

been widely recognized as a comprehensive solution for managing user identities and securing access to applications. Several studies highlight how Supabase Auth supports multiple authentication methods, including email/password-based logins, social logins (e.g., Google, GitHub), and third-party OAuth providers, which enhances flexibility in user authentication (Omotunde & Ahmed, 2023). Additionally, the incorporation of two-factor authentication (2FA), password recovery, and email verification, as noted by Aarju and Kaur (2023), strengthens the overall security by providing multiple layers of protection against unauthorized access. By adopting such robust authentication mechanisms, developers can significantly reduce the likelihood of unauthorized access, thereby protecting user data from potential threats (Li & Liu, 2021).

In terms of file management, Supabase Storage is another critical component for enhancing data security. Omotunde & Ahmed (2023) emphasize that secure file storage solutions are essential for applications that manage user-generated content. Supabase Storage organizes files into "buckets," which can be configured with public or private access levels. According to Admass et al. (2024), this granular control over who can access or modify stored files provides an added layer of security, ensuring that sensitive data is not exposed to unauthorized users. Moreover, the platform's support for file encryption plays a crucial role in safeguarding data at rest. A study by Aarju & Kaur (2023) demonstrates how encryption within Supabase Storage ensures that files, such as personal documents or media, are protected from unauthorized access even if the storage infrastructure is compromised. By applying these security measures, developers can mitigate the risks of data breaches and maintain the integrity of stored content.

By incorporating these tools and practices into web-based applications, developers can significantly enhance the overall security of their systems and data.

Studies have shown that using a secure database system like PostgreSQL, implementing strong authentication mechanisms through Supabase Auth, and ensuring secure file storage with Supabase Storage are effective strategies for mitigating common security threats (Li & Liu, 2021; Ayezabu, 2022). These measures not only safeguard sensitive data but also promote compliance with security standards, ultimately fostering trust with users and improving the overall security posture of web applications.

Synthesis of the Reviewed Literature and Studies

This study synthesized a total of thirteen (13) pieces of related literature and eight (8) related studies. The primary themes across these works include the challenges of manual HR processes, user adaptation to new data management systems, the effectiveness of implementing a data management system, and enhancing data and system security in web-based applications.

Based on the gathered literature and studies, implementing a system for Parañaque City College provides advantages such as increased efficiency, accuracy, and employee productivity, where a system mitigates traditional administrative processes, thus reducing the risk of errors associated with manual data entry. As noted in the literature, automated systems are vital for managing large volumes of data more efficiently than traditional methods. The gathered literature provided researchers with insights by addressing key issues in data handling, specifically for human resource management.

However, data migration, an important phase in transitioning to a new system, also poses challenges such as data loss and compatibility issues. According to the reviewed literature and studies, effective migration techniques should include step-by-step and careful planning, testing and deployment of the system, and comprehensive user training,

which are helpful to minimize disruptions throughout the transition. The gathered research highlights that proper strategies and tools must be employed to manage and overcome these difficulties to achieve a smooth mitigation process. Meanwhile, in deploying a new system in Parañaque City College, engaging users early in the deployment process and incorporating their feedback (as illustrated in Figure 1) will help further improve the system to meet their specific needs and requirements associated with HR administrative tasks.

In addition, securing the new system will include a series of security measures such as encryption, hashing, salting, and role-based access. Based on the gathered literature and studies, effective data protection should rely on encryption, which converts data into a more secure format preventing unauthorized access, and hashing, which is difficult to reverse-engineer. Through the implementation of salting, the security of data is further strengthened by creating different random values known as salt for each password before it is hashed, ensuring that each password is unique and providing protection against threats, thus enhancing the overall security of the data.

The security of web applications, particularly in the context of user authentication and file management, is critical to ensure that sensitive data is protected from unauthorized access and breaches. Studies consistently highlight the importance of robust authentication mechanisms in safeguarding web applications. Ayezabu (2022) underscores that effective user authentication systems are crucial for ensuring that only authorized individuals can access sensitive data. Supabase Auth, as highlighted by Omotunde and Ahmed (2023), has emerged as a comprehensive solution, supporting multiple authentication methods such as email/password logins, social logins, and third-party OAuth providers. This flexibility, coupled with additional security layers like two-factor

authentication (2FA), password recovery, and email verification (Aarju & Kaur, 2023), significantly strengthens security by reducing unauthorized access risks.

In addition to user authentication, the secure management of user-generated content and files is another vital aspect of web application security. Supabase Storage offers essential features that improve file management security. Omotunde and Ahmed (2023) emphasize that controlling access to files is crucial in applications dealing with sensitive user content. Supabase's use of "buckets" with configurable public and private access levels, as noted by Admass et al. (2024), ensures that only authorized users can access or modify files. Moreover, the platform's support for file encryption, demonstrated by Aarju & Kaur (2023), provides an additional layer of protection, safeguarding data even in the event of a storage infrastructure compromise.

The integration of secure database systems, strong authentication mechanisms via Supabase Auth, and the reliable file management system in Supabase Storage form a comprehensive approach to securing web applications. Studies by Li and Liu (2021), Ayezabu (2022), and others show that these measures not only mitigate security threats but also ensure compliance with security standards. These strategies enhance user trust and improve the overall security of web applications.

The gathered literature and studies also present the importance and considerations of communication between users, as staff may not have technological expertise in handling a system. Introducing a new system to users who are accustomed to manual processing will require them to adapt to the newly proposed system. Various studies observed that shifting to digitalization requires staff to adopt flexible learning methods to ensure that users can fully transition to the new system. These methods include system training, support, and user engagement. The studies also discovered that

a user-friendly, accurate, and well-formatted system can contribute to overall positive user experiences.

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Chapter 3

METHODOLOGY

This chapter outlines the methodologies employed in the study including research design, data collection techniques, data analysis approach, system overview and its architecture.

Research Design

This study employs a quantitative research design to evaluate the effectiveness and efficiency of the proposed data management system for the HR department. Data will be collected using survey questionnaires distributed to HR staff and employees. The surveys are designed to gather numerical data on key performance indicators, such as system usability, time efficiency, error reduction, and overall satisfaction compared to the existing spreadsheet-based methods. The data collected will be analyzed statistically to assess the system's performance and identify areas for improvement. This quantitative approach provides objective metrics to measure the system's impact on productivity and data management accuracy, ensuring a data-driven evaluation of its effectiveness.

Description of Respondents

HR personnel and staff, including the Head of the HR department and current employees from PCC, were interviewed to gather information that will serve as a guide in the development and evaluation of the proposed data management system. The respondents were chosen based on criteria that align with objectives of this study specifically due to their direct involvement in managing employee records.

Population, Sample Size and Sampling Technique

The sampling technique used in this study is purposive sampling, also known as judgmental sampling. The sampling technique was appropriate as this study aims to obtain valuable insights from participants only with relevant knowledge and experience in managing employee data and evaluating the system.

Five (5) selected employees from each category – HR department staff and from non-teaching personnel category including but not limited to supervisors and department heads and Ten (10) selected IT experts and professionals – with a total of 20 respondents. The description of respondents provided the researchers with an understanding of their perspectives on the proposed system are among the primary focus of this study.

Table 1

Distribution of the Respondents

Category	Frequency
HR Department Staff	5
Non-teaching Personnel	5
IT Professionals/Experts	10

Table 1 shows the distribution of respondents in three categories: HR Department, Non-teaching Personnel and IT Professionals/Experts. The IT Professionals/Experts category have the most respondents as they providing necessary feedback to evaluate the technical aspects of the proposed system.

Research Instrument

This study used two types of survey questionnaire for end-users and IT experts each. The researchers used the Post-Study System Usability Questionnaire (PSSUQ), a standardized tool to measure the perception of user satisfaction and experience in using a website, software, or mobile application, and other digital products or services. The PSSUQ is recognized for its reliability in evaluating system usability, providing a structured way to collect and analyze user experiences (Lewis, 1995). The survey questionnaire for users are based on the Post-Study System Usability Questionnaire (PSSUQ) to measure System Usefulness, Information Quality, and Interface Quality.

While the survey questionnaire for IT professionals/experts are based on ISO/IEC 25010 Standardized Questionnaire for Software Quality Evaluation, which focuses on assessing the system's functionality, reliability, usability, efficiency, maintainability, portability, compatibility, and security.

The responses for both questionnaires are categorized using a 5-point Likert scale with the following interpretations (5) being the highest and (1) being the lowest where:

5 – Strongly Agree: Indicates a very high level of agreement and a positive evaluation of the system.

4 – Agree: Indicates agreement and a positive perception of the system.

3 – Neutral: Neither agrees nor disagrees, showing an impartial evaluation of the system.

2 – Disagree: Indicates disagreement and a negative evaluation of the system.

1 – Strongly Disagree: Indicates a very high level of disagreement and a strongly negative evaluation of the system.

Ethical Considerations

The researchers assure that this study adheres to ethical standards through the following aspects:

First and foremost, informed consent is obtained from all participants of this study. Participants were fully informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any time without any consequences. In addition to obtaining informed consent from participants, permission is also requested from the HR department to use their resources including access to data, tools and staff needed for the development of this research.

In the context of data collection through questionnaires and interviews, any personal information and responses of participants are kept confidential and are not disclosed unless deemed necessary. Participants will be informed of their rights under the Data Privacy Act (DPA) of 2012 – an act in the Philippines protecting the right to privacy, adhering to this policy provided that any personal data that will be gathered is protected at all stages of the research process. This includes how their data will be collected and analyzed as well as the expected outcomes of the research. Participants will be given the opportunity to ask questions and express any concerns which will be addressed thoroughly.

Moreover, the researchers ensure that all sources of information are properly cited. Plagiarism will not be tolerated to maintain the originality of this research throughout the entire process.

Data Gathering Procedure

The researchers distributed the PSSUQ questionnaire face-to-face within PCC to HR personnel. However, for IT experts who are not on-site, the ISO/IEC 25010-based questionnaire was distributed electronically. This allowed the experts to complete the survey remotely, providing flexibility while maintaining data accuracy. An email invitation with a link to the online survey was sent to each IT expert, along with clear instructions for completing the questionnaire. Their responses were reviewed for accuracy of results.

Data Case Analysis

To evaluate overall system performance gathered from the questionnaire, statistical analysis will be conducted using the mean score formula. This formula calculates the average score by dividing the total sum of all responses by the number of responses. A higher mean score indicates higher satisfaction and better performance, as it reflects a more positive evaluation from users. In line with this analysis approach, it helps ensure that the system meets the usability, reliability, and effectiveness needs are identified

The formula for calculating the mean score is as follows:

Figure 3. Mean Formula

$$\overline{X} = \frac{\sum X}{N}$$

where:

- $\bar{X}$ = The mean score

- ΣX = The total sum of all responses weighted by their corresponding frequency.

- N = The total number of respondents.

Table 2

Verbal Interpretation of Mean Scores

Range	Adjective Rating	Descriptive Equivalent
1.00 – 1.80	1 – Strongly Disagree	Strongly Disagree
1.81 – 2.60	2 – Disagree	Disagree
2.61 – 3.40	3 – Neutral	Neutral
3.41 – 4.20	4 – Agree	Agree
4.21 – 5.00	5 – Strongly Agree	Strongly Agree

System Architecture and Design

Use Case Diagram

A Use Case Diagram presents functional requirements including the system's overall operations. It shows the interaction between the user and the system and vice versa to perform tasks. As described in the study of Aquino et al. (2020), the significance of use case diagrams increases with the complexity of a system requires clearer and more detailed functional requirements to understand the system's needs.

Figure 4. Use Case Diagram for Super Admin and Users
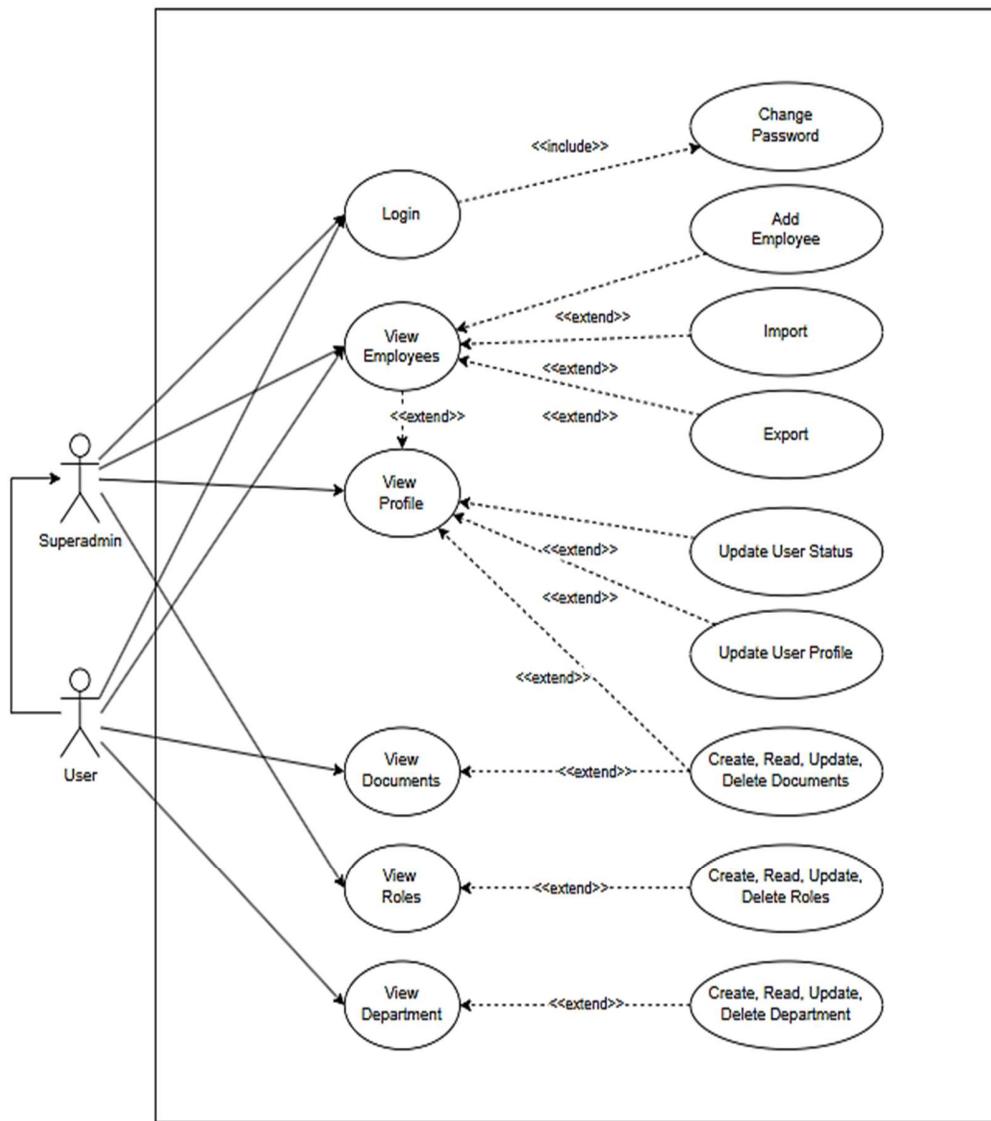
Figure 4 shows both super admin and user roles and access to the system. Super Admin has extensive control available including system management. This role is assigned for a Super Admin oversee and manage the overall operations and configurations, ensuring the system runs smoothly and securely. While the user use case

diagram presents the essential functions available to users, such as logging in, managing profiles, submitting requests, accessing notifications, viewing records. Unlike Admin or Super Admin roles, users have limited permissions and can only perform actions within their scope of access.

Table 3

Use Case Description: Regular User Login

Use Case:	User Account.	
Scenario:	Logging into the system as an employee.	
Triggering Event:	The employee attempts to log in to the system.	
Brief Description:	The employee logs into the system using the employee number and password provided by the system administrator to access authorized modules.	
Actors:	Superadmin / User	
Stakeholders:	None	
Preconditions:	The employee account must be registered in the database.	
Postconditions:	The employee successfully logs into the system and gains access to the modules permitted based on their access level.	
Flow of Activities:	**Actor**	**System**
	1. Employee enters their login credentials. 2. Employee gains access to the permitted modules.	1. The system validates the login credentials. 2. The system checks which modules are accessible based on the employee's role.
Exception Conditions:	1. If the employee number and password do not match, the system denies access and prompts the employee to re-enter correct credentials.	

	2. If the employee number is not found in the database, the system denies access to the employee.

Table 4

Use Case Description: Roles and Permissions

Use Case:	Roles & Permissions.	
Scenario:	Logging in as an admin in the system.	
Triggering Event:	Super Admin attempts to log in to the system.	
Brief Description:	Super Admin will log in to the system using Employee number and password provided.	
Actors:	Super Admin	
Stakeholders:	None	
Preconditions:	Super Admin must have a valid employee number and password.	
Postconditions:	Super Admin successfully logs into the system and gains access to the entire system.	
Flow of Activities:	**Actor**	**System**
	1. Super Admin inputs his/her login credentials. 2. Super Admin gains access to the entire system	1. The system validates the login credentials. 2. The system checks all modules that are accessible for Super Admin.
Exception Conditions:	1. Incorrect employee number or password: The system prompts the Super Admin to retry. 2. Account locked: The system prevents login after multiple failed attempts and prompts the Super Admin to reset the password.	

Table 5

Use Case Description: Adding Roles and Permissions

Use Case:	Adding Roles and Permissions
Scenario:	The Super Admin configures roles and assigns permissions to users, controlling their access and the actions they can perform within various modules in the HR system.
Triggering Event:	Super Admin selects the "Roles and Permissions" option in the system.
Brief Description:	This use case describes how the Super Admin manages roles and permissions to regulate access to specific modules (e.g., Department, Employees, 201 Files) and assigns actions (e.g., Create, Update, Upload) to ensure secure and efficient system usage.
Actors:	Super Admin
Stakeholders:	None
Preconditions:	1. The Super Admin is authenticated and logged into the system. 2. Role-based access control (RBAC) functionality is active in the system. 3. Modules (e.g., Department, Employees, 201 Files) and action types (e.g., Create, Update, Upload) are pre-defined in the system.
Postconditions:	1. A new role with defined permission is created or an existing role is updated. 2. Permissions are assigned to the appropriate users. 3. A log of the changes is recorded for auditing purposes.
Flow of Activities:	**Actor**	**System**

	1. Super Admin enters their login credentials. 2. Super Admin navigates to the "Roles and Permissions" configuration section. 3. Super Admin selects an existing role or creates a new role. 4. The Super Admin specifies the actions permitted for each module (e.g., Create, Update, Upload). 5. Super Admin assigns the role to one or more users.	1. The system validates the login credentials. 2. The system grants access to the entire system for Super Admin. 3. The system displays available roles, modules, and permissions. 4. The system prompts the Super Admin to assign module access (e.g., Department, Employees, 201 Files) to the selected role. 5. The system validates the configuration and saves the role and permissions. 6. The system notifies the Super Admin of the successful update and logs the changes.
Exception Conditions:	1. If Super Admin does not provide a name for a new role, the system prompts them to enter one. 2. If there are conflicting or incomplete permission settings, the system displays an error message and prompts for correction.	

	3. If a user other than the Super Admin attempts to modify roles and permissions, the system prevents access and logs the attempt.
	4. If the system encounters an error during role creation or assignment, it displays an error message and logs the issue for IT support.

Table 6

Use Case Description: All Employees Module

Use Case:	Manage All Employees	
Scenario:	Managing employee data and records within the system.	
Triggering Event:	Admin or HR staff accesses the All Employees module to view or modify employee data.	
Brief Description:	The HR staff or Admin accesses the All Employees module to view, edit, or manage employee records such as personal information, employment history, and status.	
Actors:	HR Staff Admin	
Stakeholders:	None	
Preconditions:	1. The user (HR Staff or Admin) must have valid access credentials. 2. Employee records must already be available in the system.	
Postconditions:	1. The HR staff or Admin successfully views or updates employee records. 2. Any changes made are saved and reflected in the system.	
Flow of Activities:	**Actor**	**System**
	1. HR staff/Admin logs into the system.	1. The system validates the login credentials.

	2. HR staff/Admin selects the "All Employees" module. 3. HR staff/Admin views or searches for specific employee records. 4. HR staff/Admin updates employee records or adds new information.	2. The system loads and displays a list of all employee records. 3. The system filters or displays the requested employee records. 4. The system saves the updated or new data into the employee database.
Exception Conditions:	1. If the user credentials are invalid, the system denies access and prompts for re-entry of valid credentials. 2. If the system cannot find any employee records, it displays an error message or an empty record list. 3. If there is a data validation error while updating records, the system notifies the user and prevents the saving operation.	

Table 7

Use Case Description: Adding Employee

Use Case:	Add Employee
Scenario:	HR staff adds a new employee's complete details into the system for record-keeping and data management.
Triggering Event:	The HR staff clicks the "Add Employee" button in the system.

Brief Description:	Allows HR personnel to input and save an employee's details, including account information, personal information, address, contact details, employment details, educational background, and government-issued numbers.
Actors:	HR Staff
Stakeholders:	None
Preconditions:	1. The HR staff must be logged into the system. 2. The necessary employee information is ready for input.
Postconditions:	1. The employee's record is successfully added to the system database. 2. The employee details are accessible for future reference and management.

Flow of Activities:	**Actor**	**System**
	1. HR staff logs into the system. 2. HR staff/Admin selects the "All Employees" module. 3. HR staff clicks the "add employee" button. 4. HR staff adds new employee. 5. Inputs Account Information. 6. Inputs Personal Information.	1. The system validates the login credentials. 2. The system loads and displays a list of all employee records. 3. The system displays the add employee window. 4. System displays the "Add Employee" form when the button is clicked. 5. System provides fields for Account Information input.

	7. Inputs Address & Contact Information. 8. Inputs Employment Details. 9. Inputs Educational Background. 10. Inputs Government Numbers. 11. Clicks "Submit."	6. System provides fields for Personal Information input. 7. System provides fields for Address & Contact Information input. 8. System provides fields for Employment Details input. 9. System provides fields for Educational Background input. 10. System provides fields for Government Numbers input. 11. System validates all inputs across sections upon "Submit" action. 12. System saves the employee record to the database. 13. The system saves the new data into the database.
Exception Conditions:	1. Required fields are left blank. 2. Inputted data contains invalid formats (e.g., incorrect email or government number formats). 3. System encounters technical errors during submission.	

Table 8

Use Case Description: Adding Employee (Import Data)

Use Case:	Import Employee Data
Scenario:	The HR staff needs to import a bulk of employee data from an Excel file into the HR system to streamline data entry and reduce manual input errors.
Triggering Event:	HR staff selects the "Import" button and uploads an Excel file containing employee details.
Brief Description:	HR staff uploads an Excel file that contains employee records into the system. The system validates the data, processes the file, and populates the employee database accordingly.
Actors:	HR Staff
Stakeholders:	None
Preconditions:	1. The user (HR staff) is authenticated and logged into the HR system. 2. The system is capable of handling Excel file uploads and has an active import function. 3. The Excel file follows the predefined format for employee data (columns for name, ID, department, etc.).
Postconditions:	1. The employee records from the Excel file are successfully imported into the system. 2. The system confirms the successful upload and notifies the HR staff of any errors or missing data. 3. If the import is successful, the employee data is accessible and can be managed within the system.

Flow of Activities:	Actor	System
	1. HR staff logs into the system. 2. HR staff/Admin selects the "All Employees" module. 3. HR staff clicks the "add employee" button. 4. HR staff adds new employee. 5. Inputs Account Information. 6. Inputs Personal Information. 7. Inputs Address & Contact Information. 8. Inputs Employment Details. 9. Inputs Educational Background. 10. Inputs Government Numbers. 11. Clicks "Submit."	1. The system validates the login credentials. 2. The system loads and displays a list of all employee records. 3. The system displays the add employee window. 4. System displays the "Add Employee" form when the button is clicked. 5. System provides fields for Account Information input. 6. System provides fields for Personal Information input. 7. System provides fields for Address & Contact Information input. 8. System provides fields for Employment Details input. 9. System provides fields for Educational Background input.

		10. System provides fields for Government Numbers input.
		11. System validates all inputs across sections upon "Submit" action.
		12. System saves the employee record to the database.
		13. The system saves the new data into the database.
Exception Conditions:		1. If the file format is not Excel (.xls or .xlsx), the system displays an error message and prompts the user to upload a valid file format.
		2. If the Excel file is missing required columns or contains invalid data (e.g., text in numeric fields), the system notifies the HR staff and provides guidance on how to correct the data.
		3. If the data import process fails due to technical issues, the system will display a system error message and may log the issue for troubleshooting.

Table 9

Use Case Description: Adding Employee (Export Data)

Use Case:	Export Employee Data
Scenario:	The HR staff needs to generate and download employee data from the system into a file format such as Excel for reporting or backup purposes.
Triggering Event:	HR staff selects the "Export" button and downloads file containing employee details.
Brief Description:	HR staff exports employee data from the system. The system allows the selection of data categories and generates a downloadable file in the specified format.
Actors:	HR Staff
Stakeholders:	None
Preconditions:	1. The user (HR staff) is authenticated and logged into the HR system. 2. The system has an active export function. 3. The data to be exported is available in the system and properly formatted.
Postconditions:	1. The requested data is successfully exported in the chosen format (e.g., Excel, CSV). 4. The HR staff can download the file. 5. A log of the export activity is recorded in the system for auditing purposes.
Flow of Activities:	**Actor**	**System**

	1. HR staff logs into the system. 2. HR staff selects the "All Employees" module. 3. HR staff clicks the "Export" button. 4. The HR staff downloads the file and reviews it for accuracy.	1. The system validates the login credentials. 2. The system loads and displays a list of all employee records. 3. The system displays the export window. 4. The system retrieves the requested data from the database. 5. The system generates the file in the selected format and makes it available for download.
Exception Conditions:	1. If the selected data category contains no records, the system displays a message informing the HR staff that no data is available for export. 2. If there are technical issues during the export process, the system displays an error message and logs the issue for IT troubleshooting. 3. If the HR staff lacks the necessary permissions for data export, the system prevents the action and notifies them.	

Table 10

Use Case Description: Adding Employee (Edit Profile)

Use Case:	Editing Employee Data
Scenario:	The HR staff needs to add a new employee's details or update the profile of an existing employee in the system.

Triggering Event:	The HR staff selects the "Add Employee" and click employee name to display "Profile" window.
Brief Description:	HR staff enters or updates employee information in the system. This ensures the employee's data is up-to-date and accurately recorded in the database.
Actors:	Super Admin, Admin
Stakeholders:	None
Preconditions:	1. HR staff must be logged in with the required credentials and permissions. 2. The system has an active "Add Employee" and "Edit Profile" functionality. 3. The required fields for employee data entry are predefined (e.g., name, employee ID, department).
Postconditions:	1. A new employee profile is successfully existing profile is updated. 2. The HR staff is notified of the successful operation. 3. A log of the addition or update is recorded for auditing purposes.

Flow of Activities:	Actor	System
	1. Super Admin/Admin login to the system. 2. The HR staff navigates to the "Add Employee" or "Edit Profile" section. 3. The HR staff enters or updates the	1. The system validates the login credentials. 2. The system displays list of employees. 3. The system displays a form for adding or updating employee details (e.g., name, ID,

	employee information and submits the form.	department, contact information, position). 4. The system validates the input to ensure all required fields are completed and formatted correctly (e.g., valid email format, unique employee ID). 5. The system saves the data to the employee database. 6. The system notifies the HR staff of the successful addition or update.
Exception Conditions:	1. If required fields are incomplete, the system displays an error message prompting the user to fill them out. 2. If an employee ID is already in use, the system notifies the HR staff to use a unique ID for new entries. 3. If there are system errors during data submission, the system displays an error message and logs the issue for IT support.	

Table 11

Use Case Description: Adding Employee (Documents)

Use Case:	Submit Document
Scenario:	The HR staff or an employee upload required documents into the system for record-keeping or compliance purposes.
Triggering Event:	The user selects the "Submit Document" option from the system interface.
Brief Description:	Users submit various document types (e.g., General Files, Diploma/TOR, Certificates, Membership of Professional Organization, Licenses) to the system. The documents are uploaded, categorized, and stored for easy retrieval and management.
Actors:	Employee HR Staff
Stakeholders:	None
Preconditions:	1. The user (employee or HR staff) is authenticated and logged into the system. 2. The system allows file uploads and supports various document types and formats. 3. The user has access to required document files for submission.
Postconditions:	1. The submitted documents are successfully uploaded and stored in the system under their respective categories. 2. The system generates confirmation of submission and notifies relevant stakeholders (e.g., HR staff). 3. A record of the upload is logged for tracking and auditing purposes.
Flow of Activities:	**Actor**	**System**

	1. HR staff/employee login to the system. 2. The user navigates to the "Submit Document" section. 3. The user selects a document category and clicks the "Upload" button. 4. The user selects the file and confirms the upload.	1. The system displays a list of document categories (e.g., General Files, Diploma/TOR, Certificates, Membership of Professional Organization, Licenses). 2. The system prompts the user to browse and select a file to upload. 3. The system validates the file format and size, ensuring it meets system requirements. 4. The system uploads and stores the file in the respective document category. 5. The system generates a confirmation message indicating the successful upload.
Exception Conditions:	1. If the uploaded file does not meet format requirements (e.g., unsupported file type), the system displays an error message and prompts the user to upload a valid file.	

	2. If the file size exceeds system limitations, the system notifies the user and prevents uploading.
	3. If the user attempts to upload a file without selecting a category, the system prompts them to choose one.
	4. If there are issues during upload (e.g., network interruptions), the system displays an error message and allows the user to retry.

Table 12

Use Case Description: Departments Module

Use Case:	Manage Departments
Scenario:	Super Admin manages and organizes departments within the organization.
Triggering Event:	Super Admin or HR staff accesses the Departments module to add, update, or delete department information.
Brief Description:	Admin or HR staff can manage department records, including adding new departments, updating existing department information, or deleting departments. This module helps in organizing employees into specific departments, enabling efficient management of resources and assignments.
Actors:	HR Staff Super Admin
Stakeholders:	None
Preconditions:	1. The user (Super Admin or HR Staff) must be logged into the system with sufficient permissions to manage department records. 2. Departments must be pre-configured or ready to be added.

Postconditions:	1. The selected department is successfully added, updated, or deleted. 2. Department records are reflected in the system for employee organization and management.	
Flow of Activities:	Actor	System
	1. Super Admin /HR Staff logs into the system. 2. Super Admin /HR Staff navigates to the "Departments" module. 3. Super Admin /HR Staff adds, updates, or deletes a department. 4. Super Admin /HR Staff saves changes or confirms deletion.	1. The system validates the login credentials. 2. The system displays a list of existing departments. 3. The system validates the input and updates the department records accordingly. 4. The system confirms the update or deletion and updates the database.
Exception Conditions:	1. If the Super Admin/Admin does not have sufficient permissions to modify roles (Admin cannot modify Super Admin roles), the system displays an error message. 2. If the role assignment or permission modification fails (due to system error or invalid role), the system notifies the user of the issue and prevents the changes from being saved.	

	3. If the user does not exist in the system or is deactivated, the system displays an error message.

Table 13

Use Case Description: Adding Departments

Use Case:	Add Department
Scenario:	Super Admin and HR staff manages and organizes departments within the organization.
Triggering Event:	Authorized Super Admin and HR staff manages to add department information.
Brief Description:	Super Admin or HR staff can add new departments.
Actors:	Super Admin, HR staff
Stakeholders:	None
Preconditions:	Departments must be pre-configured or ready to be added.
Postconditions:	1. The selected department is successfully added. 2. Department records are reflected in the system for employee organization and management.

Flow of Activities:	Actor	System
	1. Super Admin /HR Staff logs into the system. 2. Super Admin /HR Staff navigates to the "Departments" module. 3. Super Admin /HR Staff adds a department. 4. Super Admin HR Staff saves changes or confirms added department.	1. The system validates the login credentials. 2. The system displays a list of existing departments. 3. The system validates the add department records accordingly. 4. The system confirms add department and updates the database.

Exception Conditions:	1. If the Super Admin/Admin does not have sufficient permissions to modify roles (Admin cannot modify Super Admin roles), the system displays an error message. 2. If the role assignment or permission modification fails (due to system error or invalid role), the system notifies the user of the issue and prevents the changes from being saved. 3. If the user does not exist in the system or is deactivated, the system displays an error message.

Table 14

Use Case Description: 201 Files Module

Use Case:	Filtering employees by status drop down and search bar, Resets search bar and filtered status
Scenario:	HR staff and User manages filtering status, search button and reset.
Triggering Event:	HR staff and User can access it to filter status by drop down and search bar. It can also reset it to clear the filtered status or search bar.
Brief Description:	HR staff securely organizes and manages employee records, including personal details, employment history, and performance data, for efficient access.
Actors:	HR staff User
Stakeholders:	None
Preconditions:	1. The HR staff or user must have valid login credentials. 2. The "201 Files" module must contain employee data.
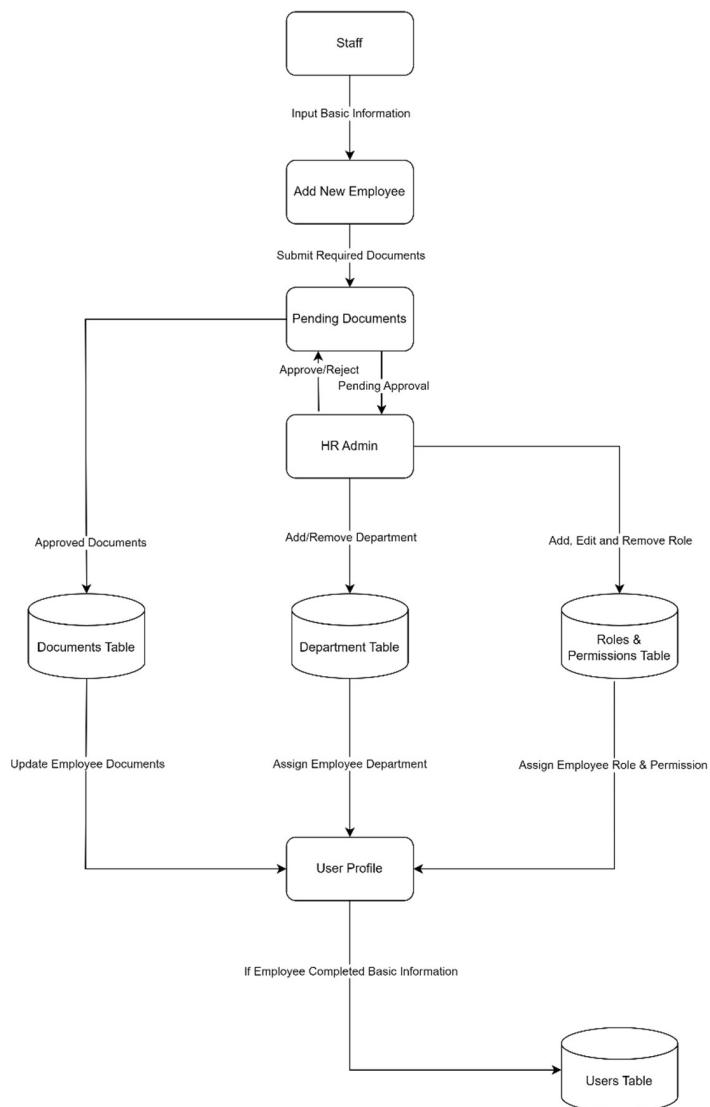
Postconditions:	1. The employee records are filtered based on the selected criteria. 2. The filters are successfully reset when requested.	
Flow of Activities:	**Actor**	**System**
	1. HR Staff logs into the system. 2. HR Staff navigates to the "201 Files" module. 3. HR Staff can filter it by status or by search bar. 4. HR Staff will reset it to clear search bar and status.	1. The system validates the login credentials. 2. The system displays a list of existing submitted files that will approve by HR staff. 3. The system validates if sets a filtered status or put details on the search bar. 4. The system confirms reset and updates the database.
Exception Conditions:	1. If the search bar has an Incomplete or invalid employee information input, the system will not display any files. 2. If the file size exceeds system limitations, the system notifies the user and prevents uploading.	

Figure 5. Data Flow Diagram (DFD)

In the DFD of the Web-based Data Management System for the Human Resources Department of Parañaque City College represents a process for managing HR document submissions and approvals for employees. It starts with the Staff inputting basic information and submitting required documents to the HR system. This submission leads to the creation of a pending status in the system, where documents await review by an HR Admin. The HR Admin evaluates the
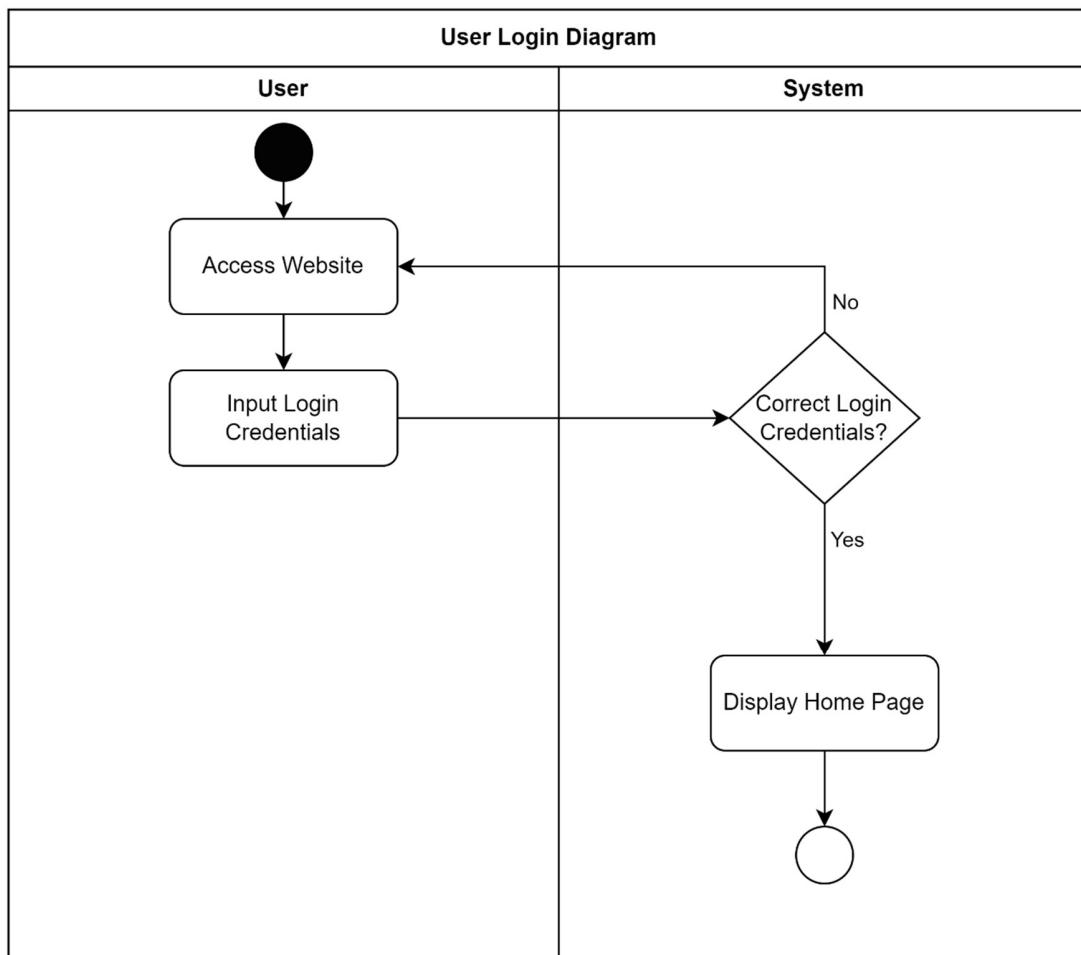
documents and either approves or rejects them. Approved documents are stored in the Documents Table, while rejections may prompt updates or resubmissions. Additionally, the HR Admin manages other HR functionalities such as adding or removing departments and assigning employee roles and permissions. Updates to employee profiles, including document updates, department assignments, or role changes, are reflected in the User Profile and stored in the Users Table. The process ensures that employee data and approvals are managed systematically, with clear pathways for document storage, role management, and departmental structuring.

Figure 6. Activity Diagram: User Login Diagram
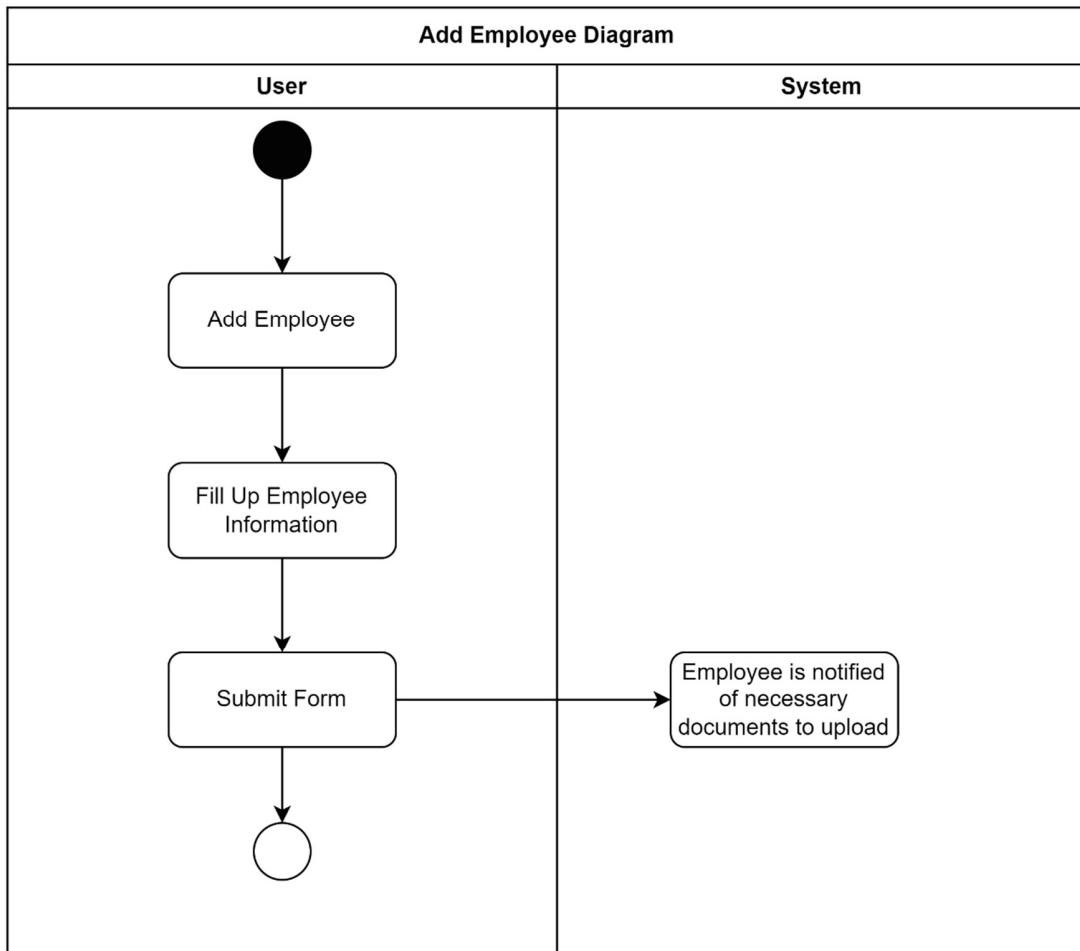
This diagram depicts the process of logging into the system. The user opens the website on a supported browser and then inputs the appropriate login credentials the system then checks if the user exists in the database otherwise the system will output an error code. Once the correct credentials are submitted the user will then be transferred to the home page.

Figure 7. Activity Diagram: Add Employee Diagram
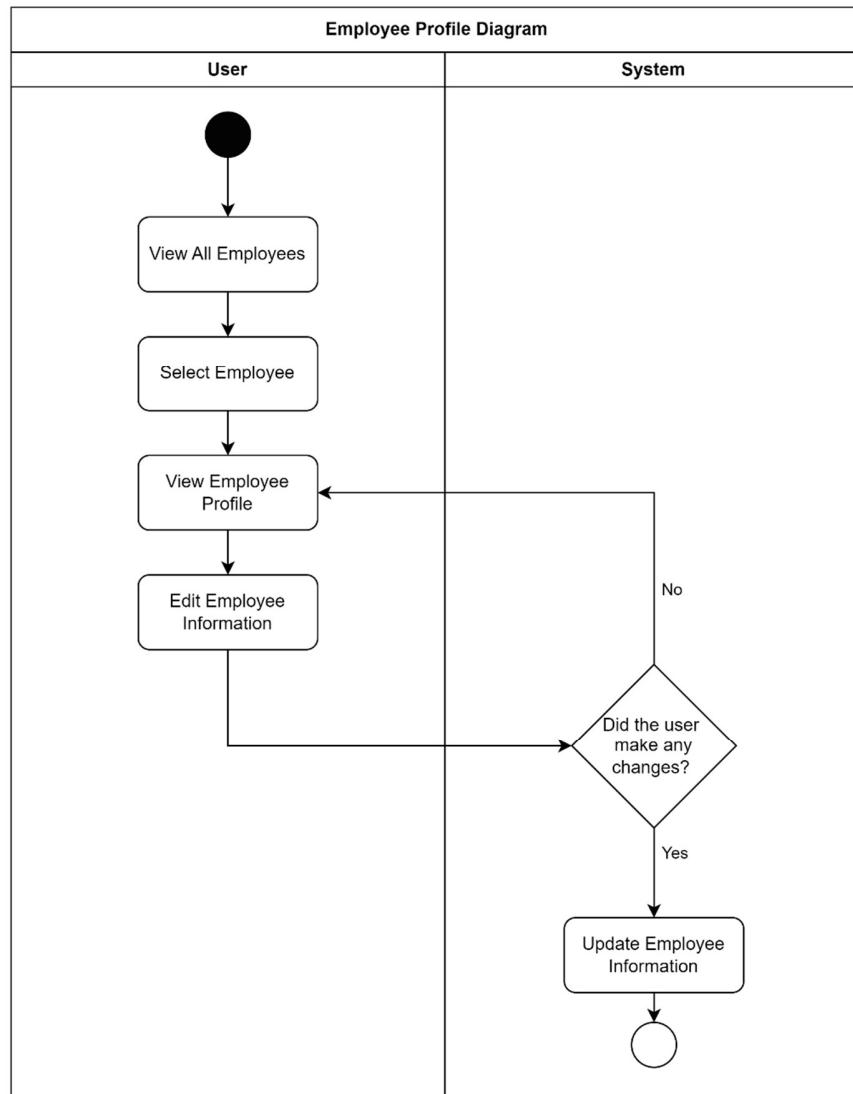
This diagram depicts the process of adding an employee to the system. The user must fill up the necessary information indicated on the form and making sure that correct information is filled out on the fields. Once submitted the profile is then created and the employee is notified what necessary documents are needed to be submitted.

Figure 8. Activity Diagram: Employee Profile Diagram
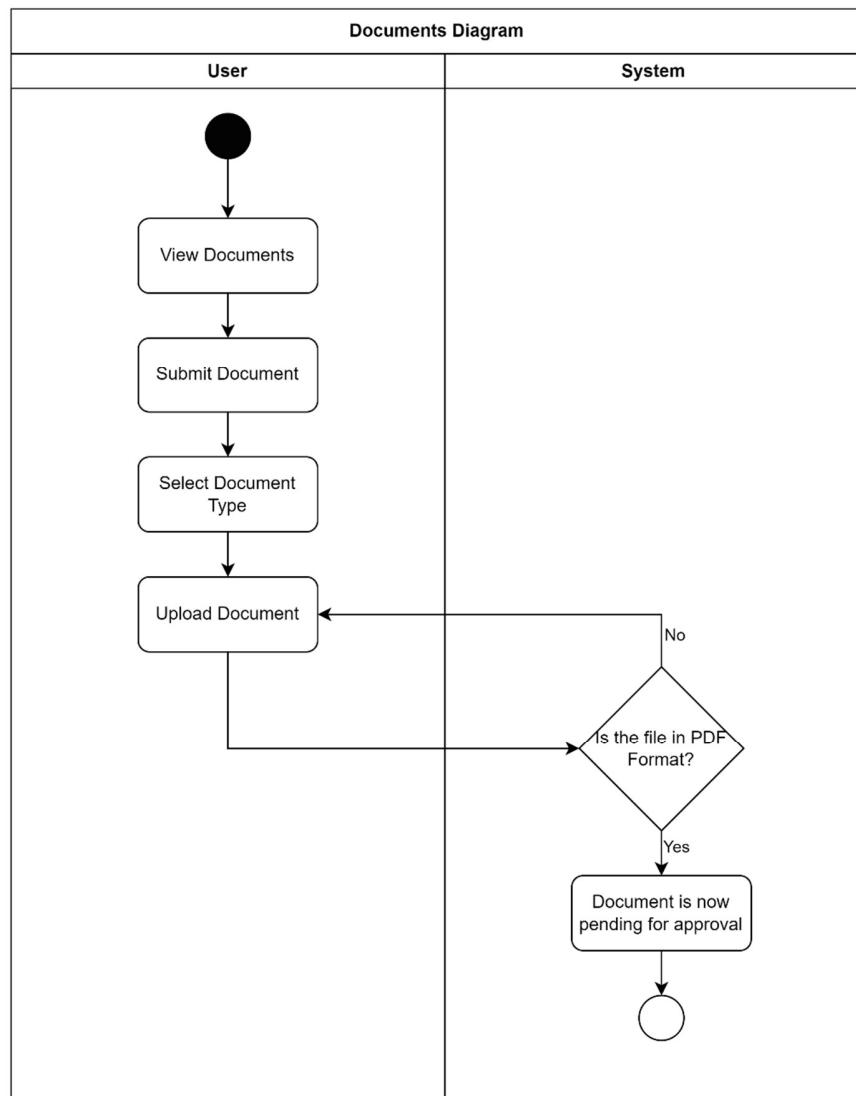
In this diagram, the Employee Profile is depicted. Here we can see the various processes that an authorized user can do on the module such as viewing and editing the information on the profile. When editing the information the form also checks if there has been any changes and returns a notification in the case

that no changes has been made. Once done editing the desired information the user submit the form and then the profile will update once the page is refreshed.

Figure 9. Activity Diagram: Documents Diagram
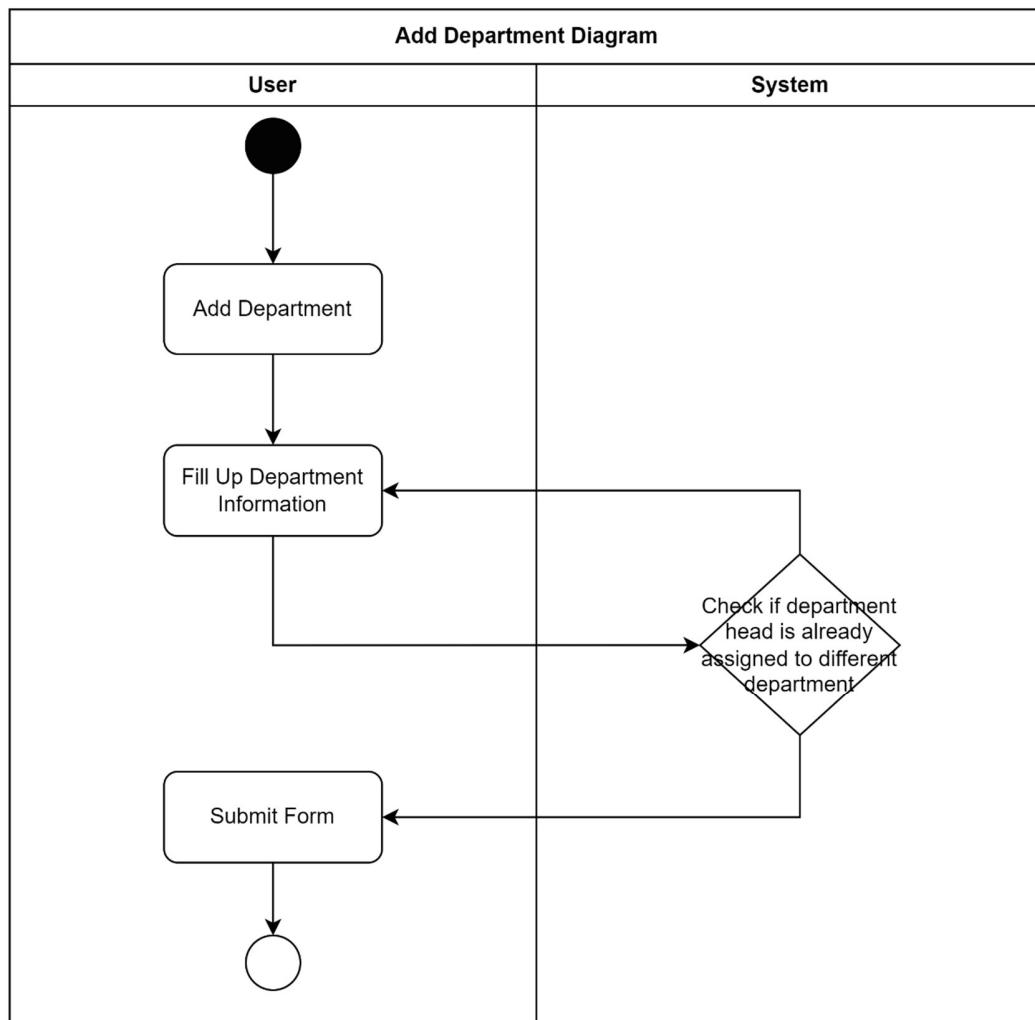
This diagram depicts the documents module on the employee profile page, this is where the user can view the status of the documents of the selected profile.

This is also where the user of the selected profile can upload his/her required documents. While uploading the system also checks if the document is a PDF and returns an error if it is not the appropriate format. Once done uploading, the status of the document updates to Pending and will await the approval of the HR or Admin.

Figure 10. Activity Diagram: Add Department Diagram
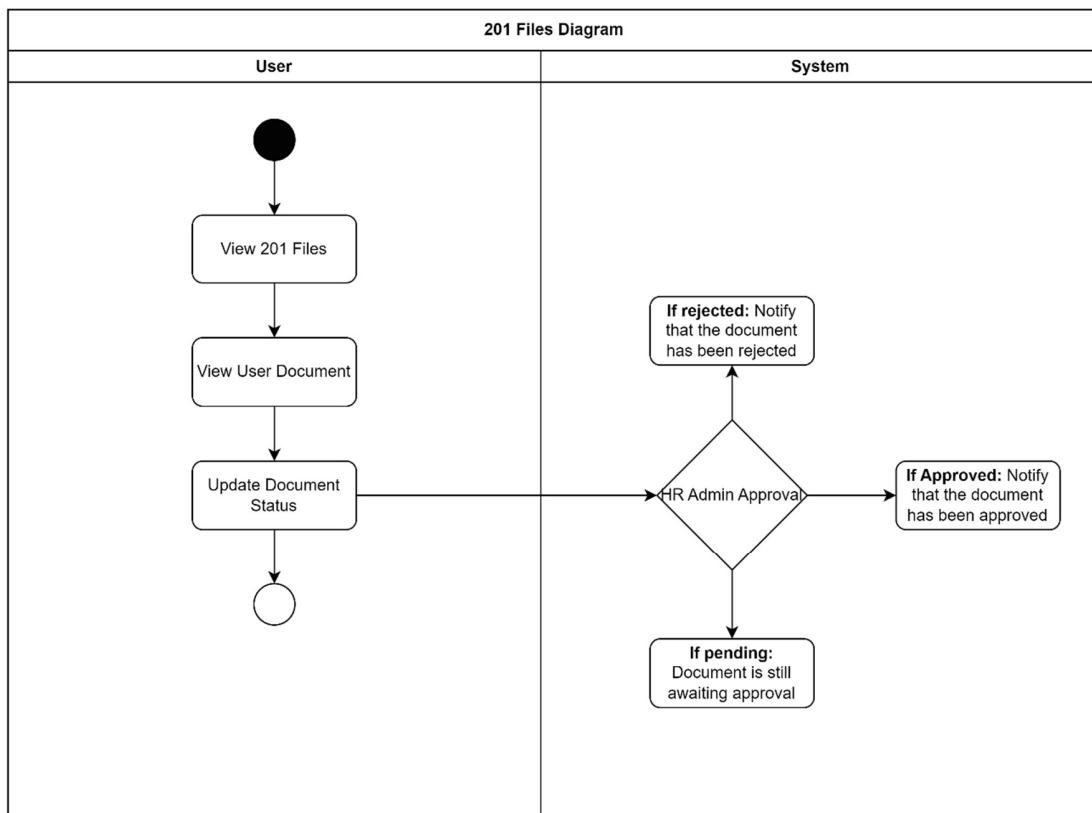
The diagram shows the process of the Add department function in the department module. In here an Authorized user can add a department to the system. When adding a department the system checks if the department already exists and prompts the user if there is already a department with the same name. When creating a department there is also the option of assigning one of the employees registered in the system to be the department, the system also checks if that employee is already the head of a different department and returns an error code if the user tries to appoint the employee as the head of another department. Once the appropriate information is filled out and no errors occur the department is successfully added to the system.

Figure 11. Activity Diagram: 201 Files Diagram
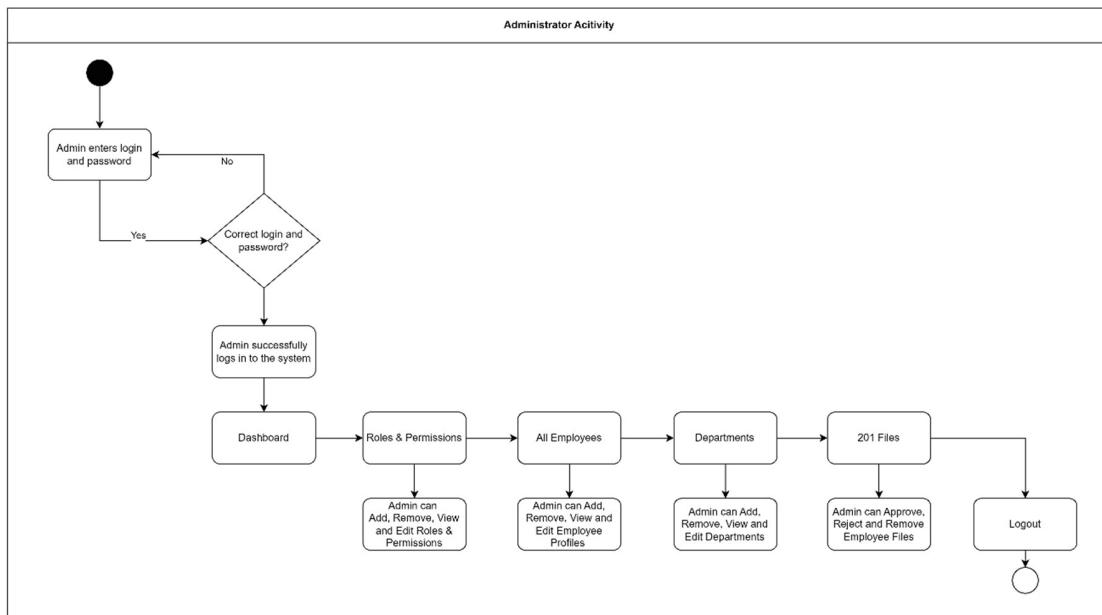
The diagram depicts the content of the 201 files dropdown module, in here a user with appropriate access can view the selected document. In here one can see the status of the selected document for all registered employees. This module's function is to update the status of documents. The user can update the status to either rejected or approved, if the status of the document is pending this means that it is still waiting to be approved or rejected. The user with access can also upload a document for the user or remove a document as per request. Once the status is updated it will also reflect on the document module of the Employee profile.

Figure 12. Activity Diagram: Administrator Activity
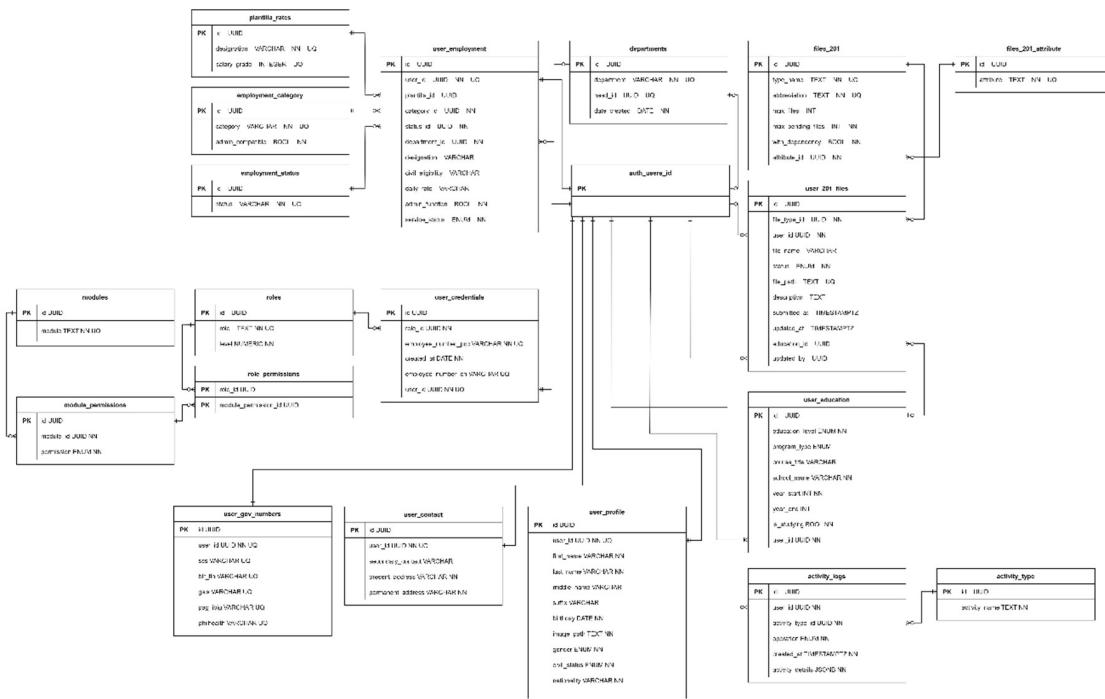
The depicted diagram here illustrates what a user with administrator status can access. Here all the functions of each module is accessible such as creating, removing, viewing and editing. One module is unique to the administrator which is the Roles & permissions module wherein an administrator can Add, Remove, View, and edit a Role and the permissions or access that is included with it. This is where the administrator can assign roles for each user and controls what each role can access specified modules in the system.

Figure 13. Entity Relationship Diagram (ERD)

System Requirements

This section discusses the overview of the hardware and software requirements needed for the development and implementation of the proposed system including software dependencies and compatibility of devices.

Table 15

System Development Software Requirements

Component	Recommended
Operating System	Windows 10 or 11
Web Browser	Google Chrome
Programming Language	TypeScript
User Interface Libraries	React, Tailwind/CSS
Database	Supabase
API Framework	RESTful

Server-side Runtime	Node.js
Cloud Service	Render

Table 16

System Development Hardware Requirements

Component	Recommended
Processor	Intel Core i5 (8th Generation or Higher)
Memory (RAM)	8gb (minimum)
Storage	100gb SSD (minimum for development)
Video Card Memory	2gb (minimum)
Development Environment	Visual Studio Code for development

Table 17

System Implementation Software Requirements
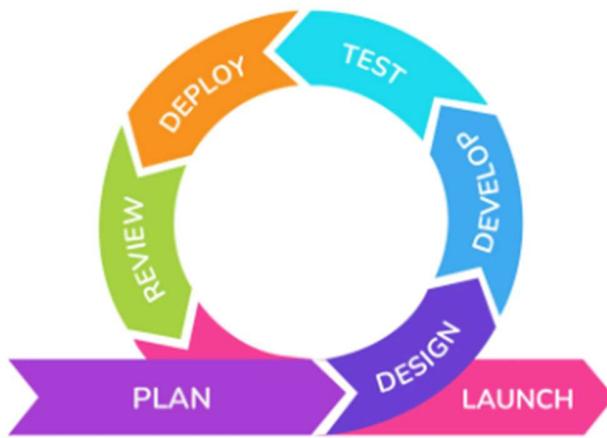
Component	Minimum	Recommended
Operating System	Windows 7 (64-bit)	Windows 10 or 11 (64-bit)
	macOS 10.13 or higher	macOS 12+
	Linux (Ubuntu 18.04+)	Linux (Ubuntu 20.04+)
Web Browser	Google Chrome (v88) or Mozilla Firefox (v85)	Google Chrome (Latest Version) or Mozilla Firefox (Latest Version)
Programming Framework	Node.js 12	Node.js 16

Table 18

System Implementation Hardware Requirements

Component	Minimum	Recommended
Processor	Intel Core i3 or AMD Ryzen 3	Intel Core i5 or AMD Ryzen 5

RAM	4gb	8gb
Storage	50gb Solid-State Drive	100gb Solid-State Drive
Internet Connection	2 Mbps	5 Mbps or higher

System Development Method

This study also employs the Agile Methodology for the development of data management system for Parañaque City College specifically HR department. This method is also employed in the study by Al-Saqqa et al. (2020), this methodology involves adaptability, allowing the key stakeholders to adjust to changes rather than strictly following an original plan. This approach helps keep the development process aligned with the goal of delivering a system that meets customer needs and expectations.

Figure 14. Agile Software Development Method

The Agile approach is an iterative process in which the system can be continuously updated and improved based on user experience and needs. Some studies have highlighted the effectiveness of Agile in promoting flexibility and adaptability throughout

the development process. In the study by Esang et al. (2024), it was found that through the iterative process of Agile methodology, the system's implementation increased in effectiveness and its capability to adapt to changes. Alzeyani and Szabó (2023), also found that the Agile methodology ensures project success without delays.

As shown in Figure 14, Agile Methodology is a flexible approach needed for continuous feedback and adaptation throughout the system's development. At the end of each step, feedback is gathered from the HR department since regular reviews and testing of the system are necessary steps for future improvements. Acquiring feedback is crucial for making necessary adjustments and refinements to the system. This process not only helps to align the system closely with user requirements but also adapts to any changes or new needs that may arise during the development phase.

Initial Planning

The foundation of any project development is initial planning that sets the direction by recognizing what needs to be achieved, why is it necessary and how it will be executed. The researchers have chosen a topic that addresses current issues and have the potential to make a benefit on key stakeholders. Initial planning began when research problems were identified by exploring into existing literature and discussions with stakeholders. The researchers implied the context of handling of employee data, present problems in an organization, including the absence of automation, reliance in manual processing of information, delayed workflows and the risks to errors are among the issues that are addressed in this phase. Additionally, planning is crucial for identifying potential obstacles and challenges that may arise during the development of the system. It highlights the

importance in addressing these issues to prevent the overall system development becoming inefficient or failing to achieve results based on objectives.

Architecture and Design

During the system development process, the researchers considered a proper architecture and design of a system to shape the functionality, scalability, and usability of the system. The architecture presents the overall structure of the system, including its components, modules and the representation of how they interact with one another, while the design details the user interface and experience. The main architecture of the system includes employee module, assigning roles and permissions, and managing departments. These modules communicate with each other via well-defined APIs, ensuring that data flows seamlessly between different parts of the system (Omotayo & Efuntade, 2023).

In the design stage, a software blueprint is used. Creating a software blueprint for the design of the system serves as a visual and technical outline or reference needed for system development. Using a blueprint approach is similar to building a physical infrastructure where detailed plans are created before construction begins. In the context of building a system, blueprints include flowcharts such as data flow diagrams (DFDs) and entity-relationship diagrams (ERDs) that helps planning and designing system's logic, workflows, and database structures to reduce likelihood of errors, delays or misalignments during the system implementation.

In User Interface (UI) design focuses on the visual and interactive features of an application. The work of Pratama & Cahyadi (2020) demonstrates that a user design ensure users can navigate the system easily and effectively. In this phase, the researchers have considered user needs and preferences in terms of navigation, functionality,

selecting visually appealing color schemes and setting appropriate interface elements within the system. According to Liu et al. (2024), a well-designed user interface (UI) improves usability and contributes to a positive user experience by making the application intuitive and visually engaging. The design process helped identify potential issues and areas for improvement, aligning with the qualities such as user-friendly and the needs of target users. Furthermore, user feedback enabled the researchers able to create a design that prioritizes the functionality of the system to be both effective and accessible to all users.

Development Stage

In the development stage of the project, transforming the design plan into a fully functional system. The researchers used modern technologies involve writing the code, developing the necessary components, and ensuring the system performs as expected. The development process ensures it is aligned to the requirements set in the design phase that all features, functionalities, and user interface elements are implemented accurately. The main part in this stage is creating user interface elements using frontend and backend development technologies. The frontend is responsible for UI where a user can make certain requests and interaction between the system making sure it provides user-friendly and interactive interaction for the user based on their needs as ultimately improving interaction efficiency and satisfaction. The backend handles the logic and data processing, as well as the integration of the databases needed to run the web application (Máriás & Molnár, 2020) to support the frontend to function properly.

Testing and Bug Fixing

This stage is essential in guaranteeing that the system achieve quality, reliability and served its overall performance before deploying. The system undergoes through a series of evaluation to identify errors and issues that may affect the functionality and user experience. To ensure that the system will work as expected, testing and bug fixing is conducted to each individual modules, submodules and each component present in the system to verify that they are working properly. Bugs and errors are also documented and prioritized based on its severity and impact. Similar approaches were used in the research of Almhana et al., (2020), where identifying and resolving issues early, the system becomes more stable. Addressing these issues, the researchers thoroughly fix codes including but not limited to validations, error handling or performance optimization in the affected parts of the system. The system is retested to guarantee the issues are resolved without introducing new ones. Moreover, testing and bug fixing is an iterative process.

Release and Maintenance

Once the system passed through testing and addressing identified issues, the system becomes available for target users. The release involves the deployment of the system to the HR department in PCC and providing them access through the internet. This phase involves uploading the system files and configuring the database through Render cloud hosting. Ensuring these steps guaranteed that the system is fully operational. Once the hosting process is complete, access credentials and necessary permissions are assigned to designated HR personnel followed by user training. In line with this, training sessions aim to help users navigate the system effectively and avoid errors in handling HR-related tasks. Findings from the study by Farias and Resende (2023) suggest that

users who found the training helpful in improving their understanding and confidence with the system were more likely to adopt and use it regularly.

In the context of maintaining the system, which is an ongoing process for the system to remain functional, secure and aligned with user needs over time. This process involves monitoring the system's overall performance and identifying emerging issues that arise and making necessary adjustments and updates to the system. Additionally, some issues that may arise were not identified during the first phase of system development especially in the early stages of testing. Maintenance is important for information systems, as it not only protects the system from potential failures (Berrade et al. 2023) but also addresses feedback from users who may suggest new features, improvements, or necessary changes to enhance the system's usability and functionality.

Implementation Plan

The researchers outlined the necessary steps in creating an implementation plan that serves as a roadmap to achieve a successful deployment and adoption of the proposed system for HR department in PCC. Following this structure allowed researchers to implement a functional and reliable system that meets the needs of its target users.

Table 19

Implementation Plan

Approach	Activities	Responsible Person(s)	Duration
Approval	Acquire a proposal from the college administrator of PCC before proceeding with the deployment	Researchers, Project Manager, College Administrator	1 day
Technology Transfer	Transition of the developed system to the HR department for full ownership.	IT Department (PCC), HR Department, Researchers	1 day

Pilot Testing	Identify issues, gather user feedback, and refine functionalities.	Quality Assurance Specialist (PCC), HR staff, Researchers	1 day
User Training	Conduct a hands-on tutorial for users.	Target users (HR Staff, Non-teaching personnel, admins) Researchers	3-6 hours estimate
Documentation	Prepare user manuals and technical guides and the documents should be accessible for future reference.	Researchers	1 day
Performance Monitoring	Monitor system performance, address bugs, and provide technical support.	IT Department (PCC), Researchers	1 day

Architecture and Design

Functional Requirements

Employee (Regular Users)

- Users can securely log in to the system using the assigned employee number.

- Users can recover their accounts through OTP or email verification.

- Users can view and update their personal information including account information.

- Users can submit/request for official business and offset forms.

- Users can upload and download personal documents necessary for employment including birth certificate, diploma and valid IDs.

- Users can receive notification about the status of their submitted documents.

Super Admin

- Super admin can log in to the system using the assigned employee number.

- Super admin can create, delete and manage user accounts for admin, HR staff and regular users.

- Super admin can assign roles and permissions to other account types including admin, HR staff, and regular users.

- A super admin has full access to all employee records.

- A Super admin can organize employee data into categories and enable efficient filtering and retrieval.

- A super admin can monitor user activity and data access logs.

HR Staff

- Staff can log in to the system using the assigned employee number.

- Staff can view, edit, and update employee records.

- Staff can upload and manage employee documents such as contracts, training records and certifications.

- Staff can print the list of employees and departments.

User Interface Design Plan
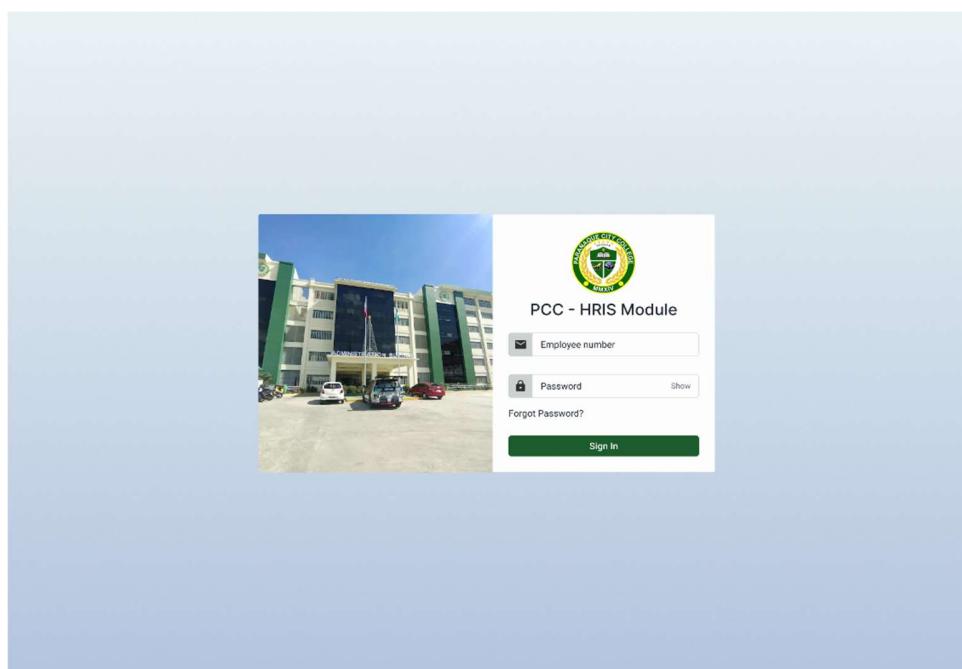
This section presents the UI and its ability to provide a responsive and smoother experience. After gathering user expectations and preferences from the target users, UI design plans were created as visual representations of the proposed interface presented during the meetings. The design plan includes interactive elements such as buttons and textboxes considering specific objectives for UI design specifically following that the interface should be visually appealing with appropriate color schemes to ensure

consistency. In addition to the design plan, modules and other features of the proposed system are added to the interface to help the target users visualize the system with its functional requirements. And finally, the system is accessible and designed to support mobile and desktop devices. Staff with assigned permissions from a super admin to manage documents of employees can tag them approved, rejected, missing or pending.
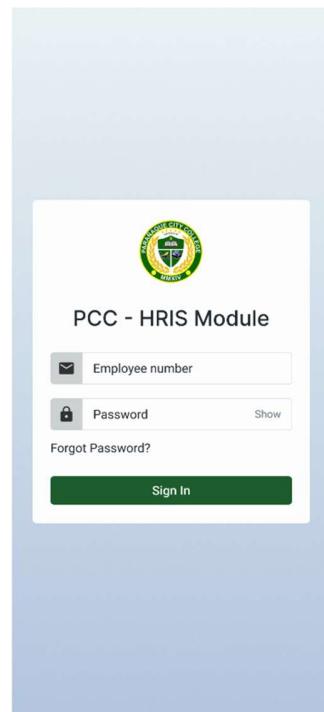
Figure 15. User Interface Design: Login Page for Desktop Mode

Figure 16 User Interface Design: Login Page for Mobile Mode

To access the system, users are required to input their PCC employee number, which is provided to all currently employed individuals. The system automatically detects the user type based on the employee number without the need for users to manually select an option whether they are an admin or a regular user to access the system directly.

Figure 17. User Interface Design: Reset Password for Desktop Mode
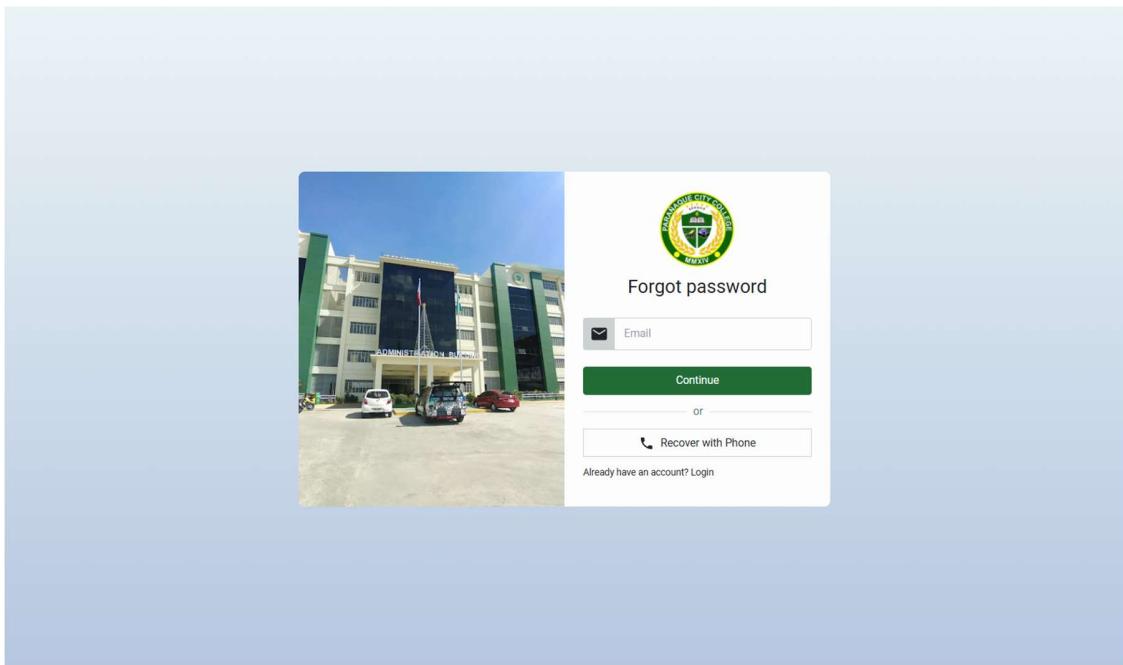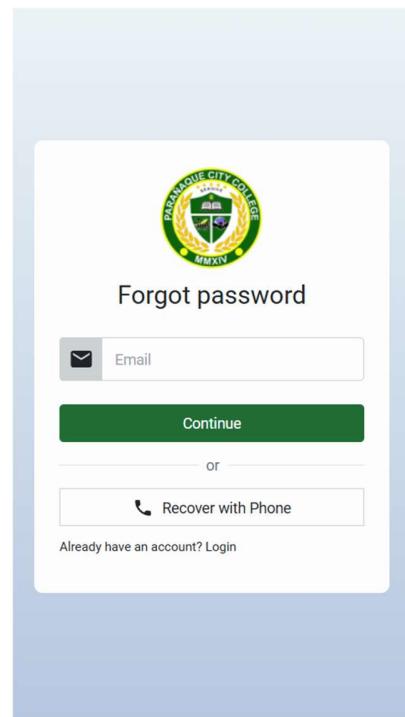
Figure 18. User Interface Design: Reset Password for Mobile Mode

As part of the login process, the reset password option enables users to request a new password through their email address or their contact number they provided during the account creation process.

Figure 19. User Interface Design: All Employees for Desktop Mode

Figure 20. User Interface Design: All Employees for Mobile Mode

The employees page displays the list of all employees within PCC that shows their basic information such as employee number, name, department, designation, category, status, service status, join date, along with options to view, edit, or update their records. A user can also click the name of an employee to quickly displays their profile page.

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Figure 21. User Interface Design: Adding Employee for Desktop Mode

Figure 22. User Interface Design: Adding Employee for Mobile Mode

Figure 23. User Interface Design: Profile Page for Desktop Mode

Figure 24. User Interface Design: Profile Page for Mobile Mode

Figure 23 shows the profile page that summarizes the information of an employee including account information, address & contact information, personal information, government numbers, employment details and the employee's educational attainment.

Figure 25. User Interface Design: Roles and Permissions for Desktop Mode

Figure 26. User Interface Design: Roles and Permissions for Mobile Mode

In figure 25, allows for managing roles and permissions within the system. This provides security measures where administrators can assign specific roles to users, such as employee, HR staff, or system administrator. Each role is associated with predefined permissions that regulate access to features and data within the system, ensuring that users can only interact with areas only relevant to their responsibilities.

Figure 27. User Interface Design: Documents Page for Desktop Mode

Figure 28. User Interface Design: Documents Page for Mobile Mode

Figure 27 presents the documents page, which organizes accepted file types, including diplomas, transcripts of records, certificates, professional organization memberships, and licenses. The page displays the submission status of each file, which can be labeled as pending, missing, rejected, or approved. It also provides information tags, such as the submission date and the last updated date. Additionally, users with appropriate permissions can add remarks or make necessary updates to the submitted files.

Figure 29. User Interface Design: Submit Documents for Desktop Mode

Figure 30. User Interface Design: Submit Documents for Mobile Mode

Figure 31. User Interface Design: Departments Page for Desktop Mode

Figure 32. User Interface Design: Departments Page for Mobile Mode

Figure 31 shows the department page where it lists all existing departments within PCC. In addition, the assigned department head and number of employees per department are also enlisted.

Figure 33. User Interface Design: 201 Files Page for Desktop Mode

Figure 34. User Interface Design: 201 Files Page for Mobile Mode

Figure 34 shows the design of the 201 Files page, where employee records like personal information, work history, and documents are organized. Additionally, this page includes search bar, filters, and sections to easily locate specific employment records.

Users with access can upload, edit, or remove files, and statuses like pending, verified, or archived help track progress.

Chapter 4

RESULTS AND DISCUSSION

This chapter discusses the results and discussion, including the system development process, statistical treatment of data, and an analysis of the system performance based on user feedback and evaluation.

Design and Development of the Proposed System

Table 20

Project Charter

Data Management System for Human Resource Department	
PROJECT CHARTER	
PROJECT NAME	Design and Development of a Web-Based Data Management System for Human Resource Department of Parañaque City College
PROJECT LEADER	Prof. Jefferson A. Costales
PROJECT MANAGER	Julian Louis N. Malabanan
CLIENT	Parañaque City College
PROJECT SPONSOR	Not Applicable
START DATE	August 2024
COMPLETION DATE	January 2025
PROJECT DETAILS	

EXECUTIVE SUMMARY	
OBJECTIVE	To design, develop, and implement a web-based data management system for PCC.
EXPECTED BENEFITS	• The system will streamline the organization of employee data related to HR processes allowing for quick filtering, retrieving, storing, and updating information. • It will provide enhanced backup and security measures of HR-related tasks for the protection of sensitive information. • The system can be access from any location as it aims to be scalable and flexibility.

STAKEHOLDERS AND THEIR RESPONSIBILITIES		
Stakeholders	**Role**	**Responsibility**

Julian Louis N. Malabanan	Project Manager/Backend and Frontend Developer, Researcher	Planning, Development, Resources, System Design, Executing Project
Reden S. Rioflorido	Quality Assurance, UI Design, Researcher	Documentation, Resources, Team Coordination, System Functionality
Keith Joshua C. Redoña	Backend and Frontend Developer, Researcher	Resources, Development, System Design, System Functionality
Hans Christian A. Arce	Quality Assurance, Researcher	UI Design, System Functionality, Documentation
Rheca R. De Robles	Quality Assurance, Researcher	Resources, System Functionality, Documentation
Prof. Erwin E. Acorda	Research Adviser	Checking, Monitoring
Roselyn D. Edora	Head of Local HRMO (PCC) - Client	Approval, Feedback, Requirement Specification, Communication, Monitoring
Jheff Orugar	ITTS (PCC)	Communication, Checking, Monitoring

Figure 35. Gantt Chart

Statistical Treatment of Data

Evaluation of the Proposed System from End-User (PCC HR Department and Non-teaching Personnel)

The evaluation of the proposed system was conducted using PSSUQ. The survey questionnaire was divided into three categories: System Usefulness (SYSUSE), Information Quality (INFOQUAL), and Interface Quality (INTERQUAL). Participants rated statements from each category using a 5-point Likert scale. A total of 10 responses were collected from selected participants from HR staff, and non-teaching staff.

Table 21. System Usefulness (SYSUSE)

System Usefulness (SYSUSE)	5	4	3	2	1	Mean	Verbal Interpretation
The system was easy to use.	2	8	0	0	0	4.2	Agree
I was able to complete tasks efficiently using the system.	1	5	4	0	0	3.7	Agree
I felt comfortable using the system.	4	5	1	0	0	4.3	Strongly Agree
Learning how to use the system was straightforward.	5	8	1	0	0	4.14	Agree
I believe I could quickly become proficient with this system.	2	4	4	0	0	3.8	Agree
				Average Mean		4.03	Agree

Table 21 presents the weighted mean for the System Usefulness (SYSUSE) category, which includes five statements related to the system's usefulness. These statements were answered by 10 respondents from the HR department and non-teaching personnel. The table highlights the overall benefits of the system for the end-users.

The findings show that users generally considered the system to be useful, with an average mean of 4.03, which falls within the "Agree" range. Most users found the system easy to use, comfortable to navigate, and believed they could quickly become proficient. They also felt they were able to complete tasks efficiently and found the learning process to be straightforward. In summary, the system met users' expectations for usability and effectiveness in completing tasks.

Table 22

Information Quality (INFOQUAL)

Information Quality (INFOQUAL)	5	4	3	2	1	Mean	Verbal Interpretation
The system provided clear instructions when issues occurred.	0	9	0	1	0	3.8	Agree
Any errors I made were easily corrected.	3	5	2	0	0	4.1	Agree
The information was clear and understandable.	3	6	1	0	0	4.2	Agree
The system's information organization was logical and easy to follow.	3	2	5	0	0	3.8	Agree
It was easy to find the information I needed.	5	8	1	0	0	4.14	Agree
The information helped me complete my tasks effectively.	2	5	3	0	0	3.9	Agree
Average Mean						4.15	Agree

In terms of Information Quality (INTERQUAL), in table 22 revealed that users have a favorable view of the system's information quality. Most participants found the system's instructions clear, and the information was easy to understand and logically organized. These aspects helped users find what they needed efficiently. The average mean scores ranging from 4.0 to 4.3 indicate a normal level of satisfaction. With an overall average

mean of 4.05, it is clear that users find the system's information quality to be very effective and useful in supporting task completion.

Table 23

Interface Quality (INTERQUAL)

Interface Quality (INTERQUAL)	5	4	3	2	1	Mean	Verbal Interpretation
I found the system's interface visually appealing.	4	6	0	0	0	4.4	Strongly Agree
I enjoyed using the interface.	4	5	1	0	0	4.3	Strongly Agree
The interface was simple to navigate.	3	5	2	0	0	4.1	Agree
This system has all the functions and capabilities I expect it to have.	1	8	1	0	0	4.0	Agree
Overall, I am satisfied with this system.	2	8	0	0	0	4.2	Agree
Average Mean						4.2	Agree

Table 23 refers to interface quality (INTERQUAL) where the system's interface was generally well-received by users. They reported that the interface was visually appealing, easy to navigate, and enjoyable to use. The system also met expectations in terms of functionality. The mean scores for these aspects ranged from 4.0 to 4.4, showing a positive response overall. The average mean score of 4.2 confirms that users are highly satisfied with the interface's design and usability, making it a key factor in their positive experience with the system.

Table 24

Data Summary Overview

Item Category	Mean Score	Descriptive Equivalent
System Usefulness (SYSUSE)	4.03	Agree
Information Quality (INFOQUAL)	4.15	Agree
Interface Quality (INTERQUAL)	4.2	Agree

Evaluation of the Proposed System from IT Expert/Professional

The evaluation of the proposed system from IT Expert/Professional was conducted using ISO 25010 Standardized Questionnaire. The survey was divided into four categories: Functional Suitability, Usability, Performance Efficiency and Security. Participants rated statements from each category using a 5-point Likert scale. A total of 10 responses were collected from IT Expert/Professional respondents.

Table 25

Functional Suitability (ISO STANDARD 25010)

Functional Suitability	5	4	3	2	1	Mean	Verbal Interpretation
The set of functions covers all the specified tasks and user objectives.	4	3	3	0	0	4.1	Agree
The function provides the correct results with the needed degree of precision.	4	4	2	0	0	4.2	Agree
The functions facilitate the accomplishment of specified tasks and objectives.	4	4	2	0	0	4.2	Agree
				Average Mean		4.17	Agree

Table 25 revealed that the system's functional suitability was rated positively by users, who felt that it effectively addressed all required tasks and objectives. The functions performed as expected, delivering accurate results and supporting users in completing their tasks efficiently. With mean scores between 4.1 and 4.2, it is clear that the system's functionalities are highly regarded. The average mean of 4.17 suggests that users are very satisfied with how the system meets their functional requirements and supports their activities.

Table 26

Interaction Capability (ISO STANDARD 25010)

Interaction Capability	5	4	3	2	1	Mean	Verbal Interpretation
Users can recognize whether a product or system is appropriate for their needs.	4	3	3	0	0	4.1	Agree
A product or system is easy to operate, control and appropriate to use.	4	3	3	0	0	4.1	Agree
A product or system protects users against making errors.	4	3	3	0	0	4.1	Agree
A user interface enables pleasing and satisfying interactions for the user.	1	6	3	0	0	4.0	Agree
A product or system can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use.	3	5	2	0	0	4.1	Agree
Average Mean						4.08	Agree

Table 26 shows the system's interaction capability where it received positive feedback, with users finding it easy to operate and well-suited to their needs. The mean scores for aspects such as ease of use, protection from errors, and overall interaction satisfaction ranged from 3.8 to 4.1, reflecting a favorable opinion. The average mean of 4.0 suggests that users find the system's interaction experience enjoyable and user-friendly, facilitating smooth and effective use.

Table 27. Performance Efficiency (ISO STANDARD 25010)

Performance Efficiency	5	4	3	2	1	Mean	Verbal Interpretation
The response and processing times and throughput rates of a product or system, when performing its functions, meet requirements.	3	6	1	0	0	4.2	Agree
The amounts and types of resources used by a product or system, when performing its functions, meet requirements.	3	4	3	0	0	4.0	Agree
The maximum limits of the product or system parameters meet requirements.	3	6	1	0	0	4.2	Agree
Average Mean						4.13	Agree

In terms of performance efficiency, the system's performance efficiency was considered adequate by most users, with the system meeting their expectations for response time, resource utilization, and parameter limits. The mean scores for these aspects ranged from 4.0 to 4.2, indicating that the system is performing well and meeting users' functional needs. The average mean of 4.13 reinforces that users are satisfied with the system's overall performance, highlighting its efficiency in handling tasks and resources.

Table 28. Security (ISO STANDARD 25010)

Security	5	4	3	2	1	Mean	Verbal Interpretation
Degree to which a product or system ensures that data are accessible only to those authorized to have access.	2	7	0	1	0	4.0	Agree
Degree to which a system, product or component prevents unauthorized access to, or modification of, computer programs or data.	4	4	2	0	0	4.2	Agree
Degree to which the actions of an entity can be traced uniquely to the entity.	2	4	3	1	0	4.0	Agree
Average Mean						4.07	Agree

In terms of security, table 28 showed that the security were highly regarded by users, who felt that it effectively protected data and prevented unauthorized access. The mean scores ranged from 4.0 to 4.2, indicating that users perceive the system's security measures to be robust and reliable. With an average mean of 4.07, it is evident that users trust the system to maintain the privacy and security of their data, contributing to their overall satisfaction.

Table 29. Data Summary Overview

Item Category	Mean Score	Descriptive Equivalent
Functional Suitability	4.17	Agree
Usability	4.08	Agree
Performance Efficiency	4.13	Agree
Security	4.07	Agree

Chapter 5

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

Summary of Findings

The evaluation of the proposed system demonstrated positive results across various categories. Using the Post-Study System Usability Questionnaire (PSSUQ), the findings revealed that the system was highly usable, with an average mean score of 4.03 for System Usefulness (SYSUSE), indicating that users found the system easy to use, efficient, and comfortable. Information Quality (INFOQUAL) was also rated positively, achieving an average mean score of 4.15, as users appreciated the clarity, organization, and accessibility of the system's information. Similarly, Interface Quality (INTERQUAL) garnered an average mean score of 4.2, highlighting user satisfaction with the system's visually appealing, simple, and functional interface. Evaluation using the ISO 25010 Standardized Questionnaire further confirmed the system's effectiveness, with Functional Suitability receiving an average mean score of 4.17, Interaction Capability at 4.08, Performance Efficiency at 4.13, and Security at 4.07. These results indicate that the system met user expectations in terms of functionality, efficiency, and security, showcasing its overall reliability and effectiveness.

Conclusion

The research study on developing the Web-Based Data Management System for the Human Resources Department at Parañaque City College aims to enhance the efficiency and accuracy of managing employee data, replacing traditional manual and

spreadsheet-based processes. The system's performance was rigorously evaluated through the Post-Study System Usability Questionnaire (PSSUQ) and the ISO 25010 Standardized Questionnaire, highlighting its effectiveness and opportunities for improvement.

Recommendations

The development and implementation of the Web-Based Data Management System will significantly improve the operational efficiency of the HR department at Parañaque City College. Moving forward, it is recommended to address any identified areas for improvement, continuously monitor system performance, and implement enhancements to adapt to the evolving needs of its users and ensure the system's sustainability and relevance.

Based on the summary findings, the following recommendations should be added to the system's overall improvements.

- Form Automation - where digital processing of employment forms, application documents, and personal data sheets (PDS).

- It is recommended that the system should include reporting tools that allow HR staff to generate detailed reports on employees' career trajectories, salary trends, and training development. Such tools could provide valuable insights for performance evaluations, succession planning, and talent management strategies.

- Integrating Employment History, providing HR with a clearer view of career progression and development needs.

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