eSPES: ONLINE REGISTRATION AND DATA MANAGEMENT SYSTEM

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Of the Requirements for the Degree
Bachelor of Science in Information Technology
Major in Service Management

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APPROVAL SHEET

This capstone project proposal entitled **eSPES: ONLINE REGISTRATION AND DATA MANAGEMENT SYSTEM** prepared and submitted by Ian Kevin P. Lising, Princess Catherine A. Mendoza and Niña Claire Alejandra V. Merhan in partial fulfillment of the requirements for the degree Bachelor of Science in Information Technology major in Service Management has been examined and is recommended for acceptance and approval for Oral Examination.

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ABSTRACT

TITLE : **eSPES: ONLINE REGISTRATION AND DATA MANAGEMENT SYSTEM**

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DEGREE : Bachelor of Science in Information Technology

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SUMMARY

The Special Program for Employment of Students (SPES) is a government program in the Philippines that aims to provide employment opportunities for students to help them pursue their studies.

The current SPES system requires applicants to physically go to the Public Employment Service Office (PESO) to register and renew their applications. This process was time-consuming and inconvenient for both the applicants and the agency, especially during the pandemic when health protocols need to be observed. The traditional process also poses challenges such as the difficulty in tracking and monitoring the applicants' status, and the tendency for data inaccuracies and duplication.

The eSPES Management System is a cloud-based system for SPES applicants using web services and database management. The system aimed to provide a more efficient and convenient process for SPES applicants and the agency in charge. With the eSPES Management System, applicants registered and renewed their applications online, eliminating the need for physical visits to PESO offices. Moreover, the system allowed better tracking and monitoring of the applicants' status and reduced the risk of data inaccuracies and duplication.

This cloud-based web system aided the accustomed application process of student applicants in DOLE's SPES Program. The project evaluated how a cloud-based system for SPES Applicants offers several advantages over face-to-face applications.

The study was limited by the scope of its focus, as it does not include the following steps for the new applicants after the registration and submission of documents, and collection of requirements, and the study was limited only to the residents and registered voters of Batangas City. The result of the study was limited by the availability and quality of data sources, and the suggestions required more testing and validation before being adopted in real-world settings. Lastly, the development of a cloud-based system for SPES required significant resources and time, and the study is not generalized to all SPES offices all over the country.

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DEDICATION

This work is sincerely and completely committed to everyone.
Who assisted and directed us in shaping our future.

First and foremost, to the creator, ALMIGHTY GOD,
the creator of all things and the source of life and love,

To our Parents,
who have given us their limitless moral and financial support
for the study's development,

To our friends,
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I.K.P.L

P.C.A.M

N.C.A.V.M

CHAPTER I
INTRODUCTION

This chapter presents the background of the study, the objectives of the study, the significance of the study, the scope and limitations of the study, and the definition of terms.

Background of the Study

Constant technological advancements have enabled different organizations to integrate manual tasks into an online system providing more and easier access to their services together with better deliverance. The Special Program for Employment of Students, also known as SPES, is DOLE's youth employment-bridging program that aims to provide temporary work to less fortunate students, out-of-school youth, and dependents of displaced or would-be displaced workers during their summer break to augment the student's family income to help ensure that beneficiaries can pursue their education.

Originally, the SPES application is being carried out in a traditional way wherein applicants have to pass documents and inquire in person. However, the increasing number of concerned students lessen the efficiency of processing and managing records resulting in a need for a centralized and reliable management system.

The Special Program for Employment of Students (SPES) is a government program in the Philippines that aims to provide employment opportunities for students to help them pursue their studies. This program offers short-term employment to students during summer or Christmas breaks, allowing them to earn money for their education and

other personal expenses. However, the traditional face-to-face registration and renewal process can be a challenge for both the applicants and the agency in charge.

The current SPES system requires applicants to physically go to the Public Employment Service Office (PESO) to register and renew applications. This process can be time-consuming and inconvenient for both the applicants and the agency, especially during the pandemic when health protocols need to be observed. The traditional process poses challenges such as the difficulty in collecting and managing the applicants' data, and the tendency for data inaccuracies and duplication.

The number of students who apply for SPES varies each year depending on factors such as the availability of positions, program popularity, and eligibility criteria. The number of applicants each year reaches up to 500 and every document submitted is evaluated individually. These applicants include SPES Babies or renewal applicants who are students that were previously granted in the program and wanted to continue employment in subsequent periods. Moreover, the number of students renewing applications also varies and is subject to program rules and regulations wherein some SPES babies were not allowed to renew their application anymore because of the availing of the program for the past four years.

The total of new applicants to be successfully employed would depend on various factors such as qualifications, available positions, and the selection process determined by the program administrators. The processing time for approving applications of new SPES applicants is more than five to seven days depending on the program's administrative procedures, the number of applications received, etc. Since only three

employees work in SPES under PESO, the validation process takes more time before students receive a confirmation or status of the registration.

To address these challenges, the eSPES Management System was developed as a cloud-based system for SPES applicants using web services and database management. The system provided a more efficient and convenient process for SPES applicants and the agency in charge. With the eSPES Online Registration and Data Management System, applicants can register and renew their applications online, eliminating the need for physical visits to PESO offices. Moreover, the system allowed better tracking and monitoring of the applicants' status and reduced the risk of data inaccuracies and duplication.

This study focused on “Industry, Innovation, and Infrastructure”, Sustainable Development Goal 9, targeting to encourage inclusive, long-term economic growth, full and productive employment, and decent work for all. This goal is critical for long-term development and can help people all across the world better their living conditions.

This study is an overview of SPES applications that use web services and database administration. The literature evaluation included standard student application registration online services and cloud-based application services. The research focused on how cloud-based SPES applications using web services and database management provided various benefits over conventional student applications, such as reliability, flexibility, dependability, and efficiency.

The eSPES Management System provided a more efficient and convenient process for SPES applicants and the agency in charge. The system addressed the challenges of the

traditional face-to-face registration and renewal process, such as time-consuming and inconvenient processes, difficulty in tracking and monitoring the applicants' status, and data inaccuracies and duplication.

Objectives of the Study

The purpose of this study is to design and develop a cloud-based website that will aid the accustomed application process of student applicants in DOLE's SPES Program.

Specifically, it:

1. Provided a more convenient way for students to access the program's services using cloud computing through:
    1.1. making an account
    1.2. registration of the applicant's credentials
    1.3. complete display of necessary information on the website; and
    1.4. provision of the user manual
2. Reduced staff workload by implementing a system that checked the quality of the uploaded files during the submission phase.
3. Established a dedicated web page for administration that centralized and migrated relevant documents for improved data management.

Significance of the Study

The study that developed a cloud-based SPES application using web services and database management has significant implications for meeting the registration and renewal for SPES by web services and database management. Based on a current information cloud-based employment management system, students' employment

locations, job-related applications, and personal information status were tracked and evaluated in real-time. The constructed dependable and effective cloud-based SPES applications using web services and database management gave the users flawless experience of different processes that are easier to access.

The eSPES Management System streamlined the registration and renewal process of the Special Program for Employment of Students (SPES) applicants. The significance of this study lies in its potential to enhance the efficiency, flexibility, and dependability of the SPES program.

The use of cloud storage and web technologies in the eSPES Management System improved the accessibility and availability of the registration and renewal process for SPES applicants. Cloud storage allowed data to be accessed from anywhere with an internet connection, while web technologies such as online forms and automated processes simplified the procurement process. This led to a more efficient, streamlined process for SPES applicants and administrators.

Furthermore, the eSPES Management System contributed to Sustainable Development Goal 9 by promoting the use of innovative technologies for social development. The system's use of cloud storage and web technologies reduced costs and improved the accessibility of the SPES program, making it easier for students to access short-term employment opportunities that can help them pursue their studies.

In summary, the eSPES Management System improved the efficiency, flexibility, and dependability of the SPES program and contributed to Sustainable Development Goal 9. The use of cloud storage and web technologies simplified the procurement

process for the registration and renewal of SPES applicants and promoted the use of innovative technologies for social development.

Scope and Limitations of the Study

The study aimed to develop a cloud-based web system that aided the accustomed application process of student applicants in DOLE's SPES Program. This project evaluated how a cloud-based system for SPES Applicants offers several advantages over Face-to-Face applications.

The project examined how cloud-based systems could be applied to manage data effectively. Furthermore, the study analyzed methods that ensured the security of the applicants' data, including the applicants' personal information, which is a significant concern for cloud-based systems.

The project culminated in the design and development of a cloud-based system for SPES that efficiently and reliably helped the applicants with eased the submission of requirements and helped the SPES personnel manage applicants' data.

The study is limited by the scope of its focus, as it does not include the interview process for the new applicants after the registration since it has to be done face-to-face and the study is limited to the residents and registered voters within Batangas City. Moreover, the study does not include the hiring process of the companies since orientations also have to be performed. The study's results are limited by the availability and quality of data sources, and the suggestions may require more testing and validation before being adopted in real-world settings. Lastly, the development of the cloud-based

system for SPES requires significant resources and time, and the study is not generalized to all SPES offices all over the country.

Definition of Terms

This section provides operational and conceptual definitions of key terms related to SPES application using web services and database management, based on relevant literature and industry standards to develop a shared understanding of the language

Cloud-Based Website. Is a website that is hosted on a remote server and accessed over the internet using a web browser. (Agrawal, 2020)

Cloud Computing. Has been widely adopted in various industries, including healthcare, education, and finance, due to its benefits such as reduced costs, improved accessibility, and enhanced collaboration. However, it also poses challenges such as data security, compliance, and vendor lock-in, which need to be properly addressed to ensure successful implementation. (Duan, Xiong & Edwards, 2019)

Database management. Refers to the process of organizing, storing, and retrieving data efficiently and effectively using software tools designed for that purpose. (Liu et al., 2018)

Dependability. Is the ability of a system or process to consistently deliver results that meet or exceed expectations. (Salah et al., 2020)

DOLE (Department of Labor and Employment). Is the government agency responsible for developing and implementing policies and programs that promote the welfare of workers and the growth of the country's economy. (DOLE, 2023)

Efficiency. Is the ability to perform tasks with minimum waste of time and resources while achieving the desired results. (Hendricks, Singhal, & Ozcan, 2021)

Flexibility. Refers to adapting and responding to changes in the environment or circumstances. (McBride, 2020)

Foster Innovation. Involves creating an environment that encourages and supports the development and implementation of new ideas, products, and services that can lead to social and economic progress. (United Nations Development Programme, 2021)

PESO (Public Employment Service Office). A local government unit in the Philippines that provides employment facilitation services to job seekers and employers. PESOs offer various programs such as job fairs, skills training, and career guidance. (The Philippine Department of Labor and Employment, 2023

Promote Inclusive. Involves taking active measures to ensure that people from all backgrounds and demographics are included and represented in decision-making and policy implementation. (United Nations Development Programme, 2021)

Resilient Infrastructure. Refers to the ability of infrastructure systems to withstand and recover from disruptive events while maintaining their basic function. (United Nations Development Programme, 2021)

SPES (Special Program for Employment of Students). Is a government program in the Philippines that aims to provide short-term employment opportunities for students during summer or Christmas breaks to help them pursue their studies. (DOLE, 2021)

Sustainable Development Goal (SDG). Is a set of 17 goals adopted by the United Nations in 2015 to guide the global community toward a sustainable and equitable future by 2030. (United Nations, 2023)

Sustainable Industrialization. Refers to the development of industrial sectors in a way that is environmentally sustainable and socially responsible, while also promoting economic growth and development. (World Bank, 2021)

Web Services. Are software systems designed to support interoperable machine-to-machine interaction over a network, often through the use of standardized protocols such as SOAP and REST. (Ahmed et al., 2019)

CHAPTER II
REVIEW OF RELATED STUDIES AND SYSTEMS

This chapter provides an overview of existing literature and systems related to the topic being investigated. This chapter guided the researchers in developing their research design by identifying potential areas for improvement and innovation.

Technical Background

This section explains the technical concepts and principles relevant to the online registration system through web services and database management and provides a foundational understanding of the underlying technologies and principles that enable the development and implementation of the solution.

Cloud Computing

Cloud computing can provide reliable, customized, and cost-effective services in a wide variety of applications (Rashid & Chaturvedi, 2019) and according to Alimboyong and Bucjan (2021), the use of cloud services is regarded as essential to both internet-based administration and delivery. According to earlier surveys, cloud services are now being used in a variety of industries throughout the world (such as public and private education, business, tourism, and scientific information).

By giving endless storage and enormous processing power capability, it provides various major benefits not only for the information and technology sectors but also for academic institutions and all government and private enterprises. Thanks to cloud technologies, businesses, and academic organizations may outsource their data at a low cost.

The growing need for storage and infrastructure has been met in large part by cloud computing. The capacity of the cloud to deliver resources like hardware and software through a network is a remarkable capability. Numerous cloud computing resources are available and may be hired on a pay-per-use basis. Broadly, we can divide the cloud into private, public, community, and hybrid clouds (Rashid & Chaturvedi, 2019).

As stated by Bhandayker (2019), the internal data center of a firm is where a private cloud is constructed. Scalable resources and digital applications provided by the cloud service provider are combined in the private cloud and made available for cloud users to utilize. Because all cloud resources and apps are managed by the business directly, similar to how an intranet operates, it differs from the wider public cloud.

Due to its limited internal exposure, private cloud usage can be significantly more secure than that of the public cloud. Access to operating a particular Private cloud may only be available to the business and designated stakeholders.

Moreover, most services of public clouds are provided in a public setting where clients can use a resource pool that is run by a host business. (Rahardja, 2020). Public clouds from Google, Amazon, Microsoft, etc. are readily available. Any enterprise or the general public can access infrastructure and services via public clouds. Hundreds of thousands of individuals share the same resources (Rashid & Chaturvedi, 2019).

In a study by Dubey et al. (2019), organizations that share the same criteria and needs turn to the community cloud to cut expenses. Resource management and job scheduling are two significant obstacles to adopting the community cloud. For businesses

with similar needs, the Community cloud model is crucial. However, using a subpar management system reduces the efficiency with which submitted applications and procedures are executed.

Putting out a new management solution for managing several businesses in a safe cloud setting. It can efficiently manage resource allocation, schedule submitted workflow on the available resources to save waste and costs while meeting deadlines, and enhance load balancing and utilization systems.

Lastly, a hybrid cloud is a combination of public and private clouds that have been tailored to meet specific business needs. Insignificantly, a hybrid cloud computing system includes both public and private clouds. In the interim, numerous private and public clouds can be connected to align with organizational objectives (Sundarakani et al., 2021). There is no location binding on the hybrid cloud, it may be located at private organization premises or Cloud Service Provider premises (Tariq, 2019).

Cloud-Based System

Businesses are leaning their attention more toward cloud-based infrastructures at a rapid pace due to its less cost and access to enhanced computing resources being a model for agility, resilience, and scale (Achar, 2019).

In a word, cloud computing is an internet technology that enables the pooling of computational resources and allows those resources to automatically scale up to meet application load demands in a certain amount of time (Llantos, 2018). In addition, individuals and businesses can receive network access to a shared pool of managed and

scalable IT resources such as servers, storage, and applications on-demand (Sunyaev, 2020).

The two components of cloud infrastructure are frontend and backend wherein the frontend is what the users see when using the system, also known as the user interface. However, the backend infrastructure—which includes data center hardware, servers, storage systems, virtualization software, routers, bridges, load balancers, adapters, applications, and services, among other things—is what powers the cloud (Achar 2019).

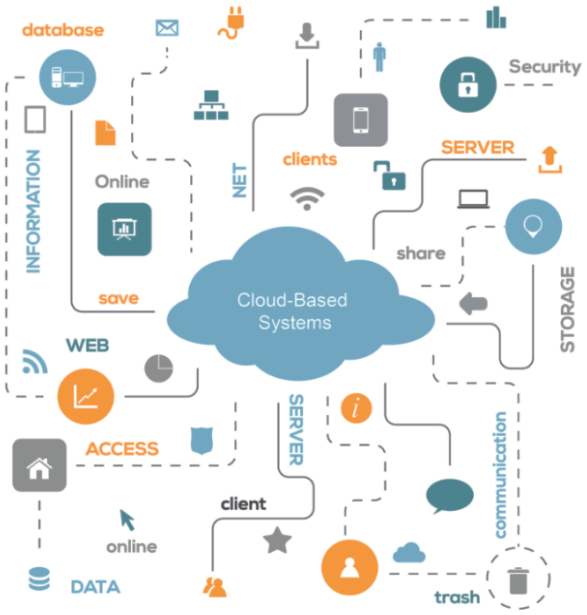

Figure 1. Cloud-Based System

Web Services

According to Driss (2020), Due to the interoperability potential it provides, web services have developed as a new technology that has drawn the attention of several technical players from a variety of industries, including e-commerce, e-learning, e-government, and other sectors. Additionally, the world of today now includes a significant amount of web services. By offering the services that consumers require to

their expectations, they assist in meeting their demands and simplifying their lives (Pandharbale, 2021).

Since the Internet was created to serve as a means of data interchange, the creation of the Web service paradigm represented a significant development. With the introduction of Web services, the Internet was transformed into a platform for self-describing, simple-to-integrate, and loosely-coupled software components (Driss, 2020).

The study also stated that ease of use is one of the key benefits of the Web service concept and in their current form, web services are conceptually restricted to a handful of straightforward capabilities that are represented by a set of activities. To satisfy increasingly sophisticated objectives, Driss (2020) then stated that it is essential to create new applications by combining services.

Lnenicka, & Komarkova (2019) stated the relevance of government enterprise architecture is increasing as a result of recent advances in the public sector that center on shared services, cloud computing, open data access, and data integration between private and public enterprises.

Data Management

Effective data management is crucial for the success of online systems, which must handle vast volumes of data created by users and transactions. Significant research has been undertaken on data management for online systems, encompassing areas such as data modeling, database architecture, and data integration.

According to Abdullah et al. (2018), developers of online systems must be focused on data modeling, highlighting the significance of including business rules within the

data model. On the other hand, Liu et al. (2020) stated that a framework for creating databases for online applications must be able to assess user needs, select appropriate database technologies, and improve database performance.

A study by Gupta & Gupta (2021) and Sarathchandra et al. (2018) have also offered several best practices for managing data in online platforms such as advice in utilizing data compression techniques to lower the storage requirements of web systems databases and highlighting the need of monitoring and assessing online system performance to discover data management challenges and areas for improvement.

Security

The distributed software architecture is where the idea of cloud computing first appeared. The goal of cloud computing technology is to offer hosted services online. Services for cloud computing are offered from data centers spread around the globe. Additionally, security is crucial to the increased acceptability of cloud computing services. (Alouffi et al., 2021).

Sunyaev (2020) and Alouffi et al. (2021) stated that utilizing cloud computing services creates security flaws and difficulties. Currently, the main cause of these difficulties and risks is cloud computing paradigms. With the capacity of computer systems, hackers take advantage of cloud models' vulnerability to access customers' sensitive data. Cloud computing requires comprehensive user-oriented security because of the complexity of its usage to protect its data and resources. In reality, one of the key problems with cloud security is that cloud service providers have complete control over how data given by users is stored and processed. Identification, authentication,

authorization, and access management concerns are included in this area of security (Tabrizchi & Kuchaki, 2020).

Incorporating cloud computing in web systems, similar to what will be applied on the web system, heightens the security against other malicious acts and intruders compared to regular and traditional hosting methods.

Online Application

In recent years, online job applications have grown in popularity, and many employers now require applicants to submit their applications online. A lot of study has been done on this subject, including studies on the advantages and disadvantages of online job applications as well as the best methods for developing and implementing online application systems.

According to a study by Breaugh & Stark (2018), using online job applications can boost both the recruiting process' speed and the candidate pool's diversity, and lessen the time to fill job vacancies (Hausknecht et al., 2018). Online job applications, however, may also have disadvantages, such as the potential for biases in applicant selection and the requirement that candidates negotiate challenging application processes. (Crosby & Freedman, 2019).

Researchers have suggested several best practices for developing and implementing online application systems to help reduce these problems. For instance, one research suggests giving candidates who may be unfamiliar with online application systems technical help and using clear, simple language in the application instructions (Gawehn & Holmes, 2019). The further study recommends taking steps to lessen bias in

application screening, such as using structured interviews or doing blind resume reviews. (Barakat & Ollier-Malaterre, 2021).

While there are many advantages to online job applications in terms of speed and variety in the recruiting process, there are also some possible drawbacks that need to be considered in the design and implementation process.

Serverless Computing

Serverless computing has grown in favor of an alternative to traditional server-based designs for web systems in recent years. Serverless computing divides programs into discrete, event-driven functions that are run in response to specified triggers or events, such as a user request or data change. This method eliminates the requirement for server management and provisioning, allowing developers to focus on developing code rather than infrastructure management.

Serverless computing for web systems has been researched in terms of design, performance, security, and cost-effectiveness. A serverless design for online systems entails dividing programs into microservices and putting them on a serverless platform (Li et al., 2019). It was discovered that serverless computing for web applications can have considerable cost savings and scalability benefits when compared to standard server-based systems (Islam et al., 2020).

Studies have highlighted various security concerns with serverless computing, including the necessity for the safe setup of serverless operations and protection against threats such as code injection and data theft (Buchanan et al., 2021). Kaur et al. (2019)

have proposed numerous measures to overcome these difficulties, including access control rules, monitoring and logging, and encryption strategies.

Another major feature of serverless computing is cost-effectiveness, and various studies have compared the expenses of serverless computing to traditional server-based systems. According to Baldini et al. (2018), serverless computing can yield considerable cost reductions for certain types of workloads while being ineffective for others. Moreover, Yu et al. (2019) developed a serverless computing cost model that takes into account elements such as function execution time, memory utilization, and data transmission.

Related Systems and Studies

This section demonstrates the researchers' familiarity with the current state of the field and identifies the gaps or limitations of existing studies or systems. The researchers discussed various related studies and systems, including their strengths and weaknesses, research questions, methodologies, and findings. The researchers also compared and contrasted their study or system with existing ones, highlighting the unique contributions of their work.

Cloud-Based Application System

A study by Sood et al. (2019) developed a cloud-based employment management system to improve the recruitment and hiring process. The system used web services and database management to automate job postings, applicant tracking, and resume screening. The study found that the system improved efficiency and reduced costs for the organization.

Moreover, Tan & Lee (2020) explored the use of cloud computing for government services in Malaysia. The authors developed a cloud-based e-government framework that used web services and database management to provide online services to citizens. The study found that the framework improved accessibility, efficiency, and user satisfaction with government services.

According to Pradhan et al. (2021), a cloud-based system was developed to register and renew business licenses in India. The system used web services and database management to automate the application process and reduce processing times. The study found that the system improved transparency, reduced corruption, and increased revenue for the government.

A cloud-based system for the registration and management of government-funded employment programs in Pakistan. The study showed that cloud-based solutions could improve the efficiency and accessibility of employment programs, reducing costs and enhancing the overall effectiveness of the programs (Khan &Ullah, 2020).

Alrubaiee and Al-Naimi (2021) proposed a cloud-based system for the management of training and employment programs in the UAE in their study. It shows that cloud-based solutions could improve the scalability, reliability, and accessibility of employment programs, enhancing their overall impact on the labor market.

In addition to these studies, several cloud-based solutions incorporate manual approaches in a variety of disciplines. For example, the Open Data Kit (ODK) is a popular open-source platform for digitizing manual methods such as surveys and forms

and collecting data in the field. The technique has been applied in a variety of fields, including medicine, agriculture, and disaster relief.

Cloud Computing

The system utilizes cloud computing, which allows delivery of computing services over the Internet. Cloud computing offers several benefits, including scalability, cost-effectiveness, and accessibility, which make it an ideal solution for the SPES program (Liu & Chen, 2019).

A study evaluated the implementation of the Special Program for Employment of Students (SPES) in the Philippines and identified challenges in the registration process. The study highlighted the need for an efficient and accessible online registration system that could help overcome the challenges faced by SPES applicants and improve the overall implementation of the program (Raymundo & Adaro, 2018).

In addition, Liu and Chen (2019) proposed a cloud-based framework for a student employment service platform that integrated online registration, job matching, and payment management. The study showed that cloud-based solutions could provide scalability, accessibility, and cost-effectiveness for the SPES program, making it more sustainable and efficient.

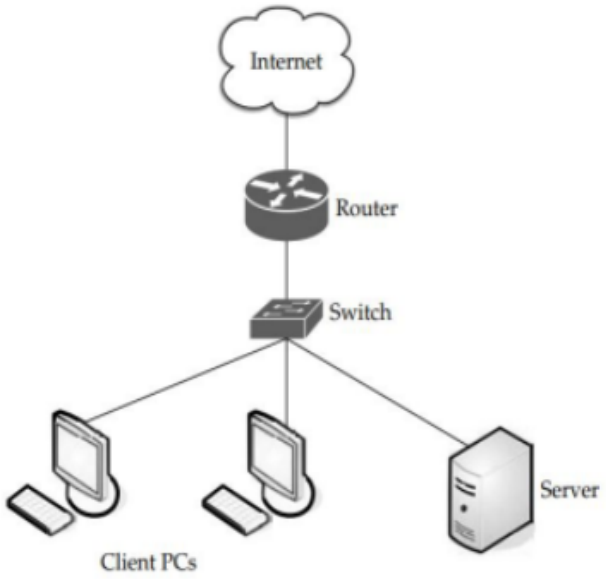

Figure 2. Cloud Computing

Database Management

The system uses database management principles to store and manage applicant data. Database management ensures data integrity, security, and availability, allowing for efficient and effective data management (Gartner, 2020).

Effective database administration is crucial for the success of systems, particularly web-based and cloud-based systems that demand efficient data storage, processing, and retrieval. Significant research has been undertaken on database administration for web and cloud-based systems, including areas such as data modeling, database architecture, indexing, and query optimization.

Feng et al. (2019) suggested a multi-level database design for cloud-based systems, which incorporates a distributed metadata management system and a shared-nothing data processing architecture. However, Pandey et al. (2021) concentrated

on indexing approaches for large-scale web systems, offering a hybrid index structure that combines the advantages of inverted lists and B-trees.

In addition to indexing, query optimization for cloud-based systems was investigated, and a framework for query optimization in cloud-based systems was provided (Ganguly et al., 2019). Agrawal et al. (2020), on the other hand, concentrated on query optimization for geospatial web systems, offering a hybrid strategy that blends R-tree and B-tree indexes.

Various practices for managing databases in online and cloud-based applications were proposed by Sohn et al. (2018) and Gupta et al. (2021) suggesting to adopt of containerization technologies such as Docker to segregate and manage database systems and underlines the necessity of automated database tuning to increase query efficiency and decrease database maintenance efforts.

Effective database management is critical for the success of web systems and cloud-based systems, and researchers have several best practices and frameworks for data modeling, database design, indexing, and query optimization.

Sustainable Development Goal (SDG) 9

Goal 9 of the Sustainable Development Goals aims to encourage long-term industrialization and innovation via the development and application of new technologies. Integration of manual methods with cloud-based technologies is one area of study related to SDG 9. This entails automating conventional manual manufacturing procedures, which can enhance productivity, lower costs, and encourage sustainability.

One research (Oluwole et al., 2018) focuses on the integration of manual techniques with cloud-based technologies in the context of the construction sector. The research presented a framework for integrating manual techniques into a cloud-based system, which included identifying relevant manual methods, digitizing them with appropriate technologies, and integrating the digital methods into a cloud-based platform. According to the study, integrating manual processes with cloud-based technologies might boost production and save costs in the construction business.

Another study examined the integration of manual procedures into a cloud-based disaster management system (Kaur et al., 2020). The study offered a framework for combining manual disaster management approaches, such as paper-based forms and surveys, into a cloud-based system. The framework entailed digitizing manual procedures, creating appropriate workflows and processes, and incorporating digital methods into a cloud-based platform. The study discovered that integrating manual methods into a cloud-based system might speed up and increase the accuracy of data collecting and analysis in disaster management.

Overall, the integration of manual methods into cloud-based systems is a promising area of research that has the potential to contribute to SDG 9 by fostering sustainable industrialization and innovation. Several research and systems have shown that this technique has potential benefits in a variety of disciplines.

Synthesis

The eSPES Management system interacted with applicants and SPES personnel via a cloud-based website. A cloud computing infrastructure was used to provide

dependable, personalized, and cost-effective services with varied functions and features. The application procedure will be easy to access if this technique is used. Furthermore, in terms of security, a cloud-based system is less susceptible to viruses, putting all worried users at ease when relying on the online system. The capacity for endless storage and tremendous processing power will give several important benefits to institutions at a reasonable cost.

The eSPES Management system used a community cloud infrastructure since its service is limited to all student applicants in Batangas City. By integrating the traditional practices for SPES in a web system, the relevance of government enterprise architecture was advanced since study shows that it is a result of recent advances in the public sector that center on shared services, cloud computing, open data access, and data integration between private and public enterprises. The data management on the web system was able to handle vast volumes of data created by users and transactions, focusing on data modeling by highlighting the significance of including business rules within the data model.

Studies showed that cloud-based solutions provide scalability, accessibility, and cost-effectiveness for the SPES program, making it more sustainable and efficient, while database management ensure data integrity, security, and availability, allowing for efficient and effective data management, the project of developing the system contributed to Sustainable Development Goal 9, which aims to encourage long-term industrialization and innovation via the development and application of new technologies. This innovation will enhance productivity, lower cost, and promote sustainability.

Conceptual Framework

Online application registration and renewal have become a crucial component of today's mode of job applications integrating past processes into a more efficient way. As a result, there has been a surge in demand for dependable, efficient, and scalable online registration and data management system. The project is a cloud-based CDN capable of addressing these difficulties and contributing to the fulfillment of SDG 9, which highlights the importance of resilient infrastructure and sustainable industrialization.

The conceptual framework of the Online Registration and Data Management System is composed of three main components: the cloud infrastructure, the web services layer, and the database management layer.

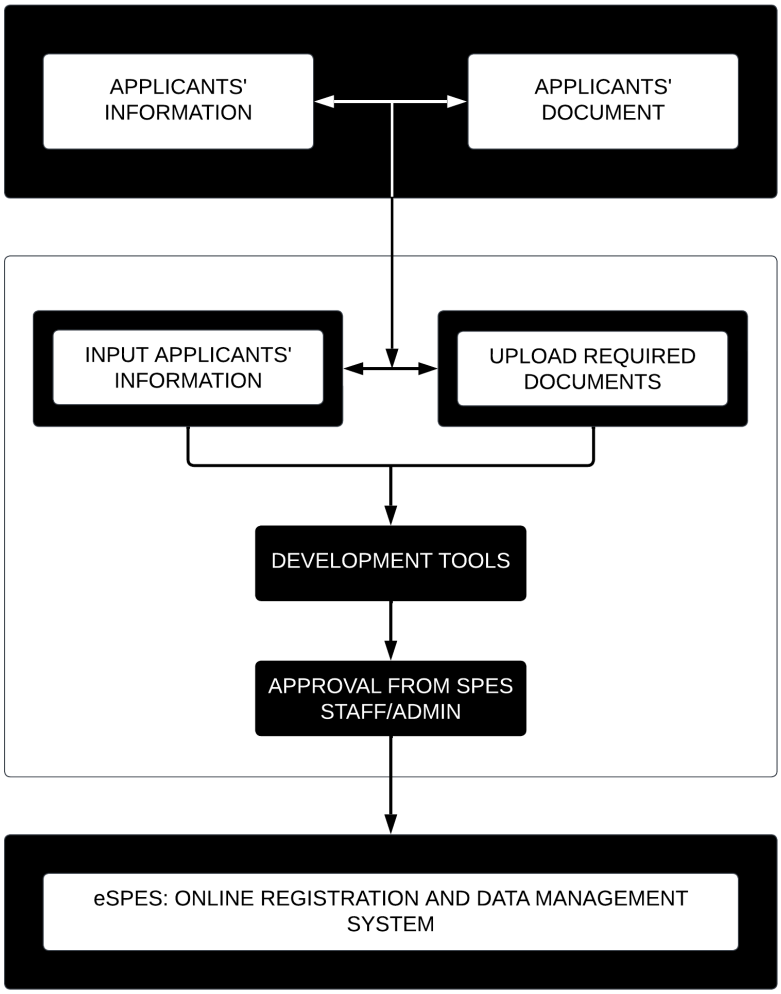

Figure 3. Conceptual Diagram

The cloud infrastructure layer acted as the proposed system's base, supplying essential computer resources such as servers, storage, and networking components. Cloud computing enabled system deployment through the internet, giving accessibility, scalability, and cost-effectiveness.

The web services layer provides communication and interoperability across system components. Web services provided a standardized method of communication via the Internet, allowed the seamless flow of data across the many levels of the system and eased the integration of diverse software applications.

The database management layer served as an administrative center for applicant data storage and administration. This layer assured data integrity, security, and availability, making it possible to manage data more efficiently and effectively. The application of database management techniques like normalization and indexing guaranteed that data is structured and retrievable, allowing for better decision-making and analysis.

The Online Registration and Data Management System was built on the interaction between these three levels. The cloud infrastructure layer supplied the system with the resources requirement, the web services layer enabled communication and integration, and the database management layer managed data efficiently and effectively.

Overall, the conceptual framework laid the groundwork for the creation and implementation of a streamlined and successful cloud-based system for SPES candidates. This enabled the system to use the benefits of cloud computing, online services, and data administration, resulting in a scalable, accessible, and cost-effective solution.

CHAPTER III
DESIGN AND METHODOLOGY

This chapter focuses on design and methodology. It discusses the software development model, where the researchers used the agile methodology approach, the analysis of the existing system, fishbone analysis, system boundary, hardware and software requirements, software requirements specification, as well as functional and non-functional requirements, constraints, multiple designs, security, and trade-off. System Design provides precise or in-depth data for the web-based to meet the needs and expectations of the applicants and admin.

Software Development Model

An organized plan and complete control over the procedures during the entire project were made possible by a software development methodology. The researchers opted for the Agile Development Model where the development of the system to accomplish the study's goals followed the methodology.

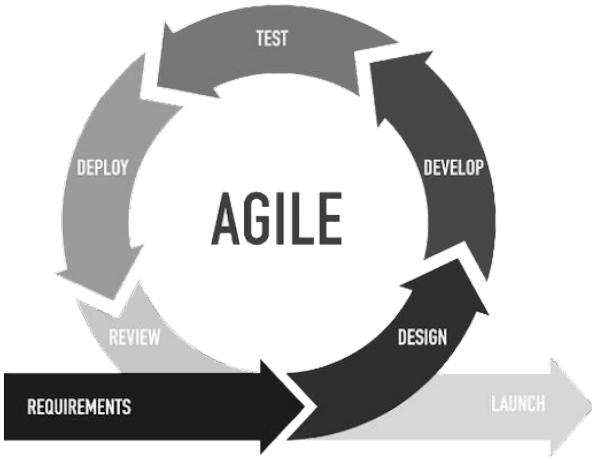

Figure 4. Agile Development Model

Figure 4 this diagram illustrates the steps involved in creating a web application and the used roadmap to expedite and improve development. With increased productivity, the project team became more effective.

The aim of the project and the general flow of the development was included in the developers' comprehensive plan during planning which minimized risks and shortened development time. The study has a critical plan, which provides a thorough grasp of the functionality and design of the project, has a period, and has any other aspects that need to be considered in the project development, to deliver great products. Given that, the following are the many stages and subprocesses used by the study's researchers:

a. **Analysis.** This phase defined the project purpose and scope, identified the needed requirement for the scope of the study. This also engaged the stakeholders to ensure that their needs and concerns were taken into account during the project planning phase.

Define project purpose and scope. The researchers defined the purpose and scope of the project that ensured everyone involved had a clear understanding of what the project aimed to achieve and the boundaries of the project.

Project Planning. The study's researchers engaged in project planning that established a roadmap for the project, outlined the necessary resources, milestones, and timelines which ensured that the project stayed on track.

Stakeholder engagement. Involved all relevant parties throughout the project, ensuring that their needs and expectations were met and that the project achieved its goals.

b. **Design**. In this phase, the researchers of the study conducted requirements analysis and prototyping and determined the features and functionality needed for the software. The researchers also designed the system architecture which ensured that the software was scalable, maintainable, and secure. Moreover, the measures that makes up this process are:

    Requirements Analysis and Prototyping. The researchers conducted requirements analysis and prototyping which ensured that the final product met the needs of the stakeholders and that the development process was efficient.

    System Design. System design involved the creation of a detailed plan for the architecture, components, and functionality of the final product.

    The proponents emphasized the importance of design, recognizing that it would lay the foundation for the success of the project.

c. **Development**. During the development phase, the researchers wrote the code, designed the user interface, and developed the database schema following the Agile principles by delivering small, frequent iterations of working software. In addition, the approaches involved in the process are:

    Coding. This stage involved the actual writing of the software code, where it was ensured that it was efficient, effective, and met the project's requirements.

UI Design. It focused on the creation of a user-friendly interface that made it easy for end-users to interact with the system.

Database Design. It involved the development of a well-structured database that handled the storage and retrieval of data.

d. **Testing/Integration**. In this phase, the researchers synchronized data between different parts of the system, performed quality assurance checks, and conducted software testing to ensure the software worked as intended. With this, enumerated are the steps associated with this phase.

Data Synchronization. Ensured that all data was accurate and up-to-date across all systems and databases.

Quality Assurance. Focused on the testing and validation of the final product, ensuring that it met the required quality standards.

Software Testing. It was conducted which identified and fixed any issues or bugs that have risen during development.

e. **Implementation**. The implementation phase involved deployment of software to production environments and made it available to end-users. The team deployed the system to the production environment and made sure everything was working as intended.

e. **Maintenance**. After deployment, the proponents continued maintaining the software by managing risks and making updates to address any issues or bugs that were identified. They followed Agile principles by continuously improving the software to meet the changing needs of users.

Risk Management. Risk management is a critical component of the maintenance stage. It ensured that any potential risks or issues were identified and addressed promptly to avoid any adverse impact on the project.

Analysis of the Existing System

As the PESO (Public Employment Service Office) opens the SPES application every summer season, a lot of Students from different schools send their applications to the PESO to apply for a temporary position at a specific company. In the previous process, the applicants will go to the PESO to register and pass their requirements physically. The PESO staff will manually go through every registration form.

The submission and collection of the registration form was sent physically and managing the applicants' information was difficult. As such, the researcher sought a solution that replaced the paper-based decentralized system of managing data relevant to the application process.

Fish Bone Analysis

The fishbone diagram presented in Figure 5 was characterized by a brainstorming session held by the researchers that systematically identified a wide range of possible causes and further categorized potential causes of problems or issues in an orderly manner. As such, the researchers assessed each bone's validity by analyzing data and finding common ground on which bones are improbable.

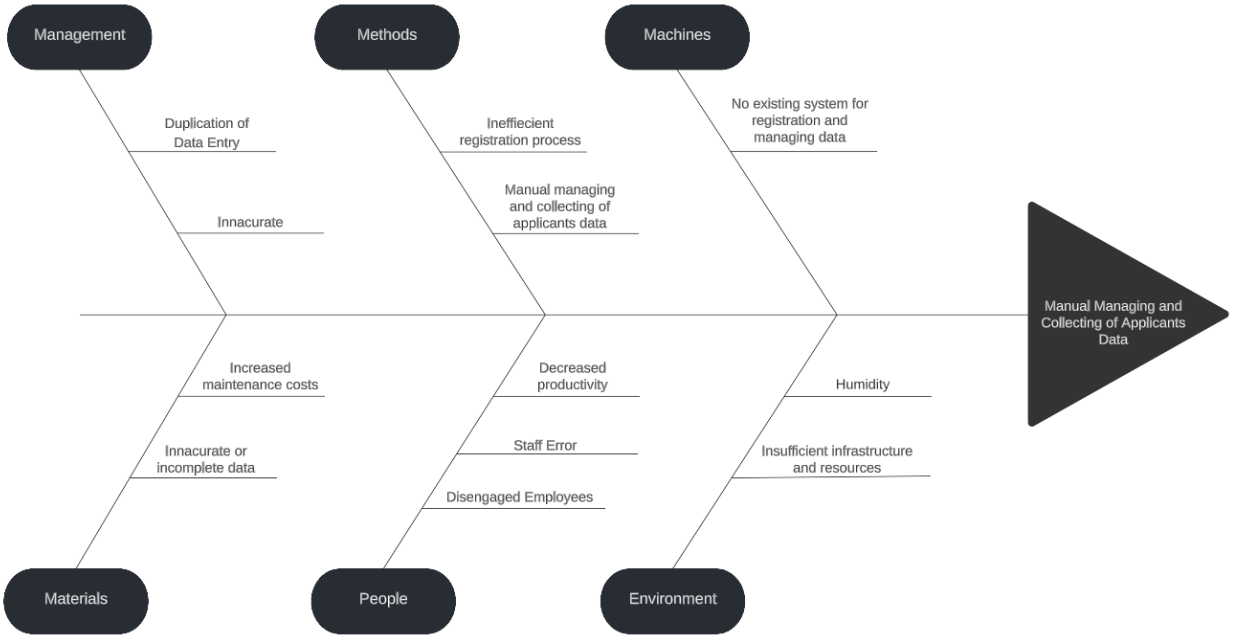

Figure 5. Fishbone Diagram

Employing the fishbone analysis, the researchers identified six causes in the accreditation process namely Management, Methods, Machines, Materials, People, and Environment including their respective effects. The researchers stated the most important bone pointed to a human aspect as the likely source of the problem: a lack of coordination among parties. Furthermore, as significant drivers of the problem, variances in management structure and insufficient communication were assessed to be the main causes throughout the certification process.

System Boundary

Identifying and establishing the components within the system and what was outside the environment were critical components of system design. As a result, the system boundary had to be established, as shown in Figure 6. According to the diagram,

the dashed line acted as a border that divided the internal components and entities of the accrediting system from the external entities, or the so-called environment. In particular, among the identified external entities were the accrediting agencies, such as PESO and DOLE, which provided the inputs and consumed the output.

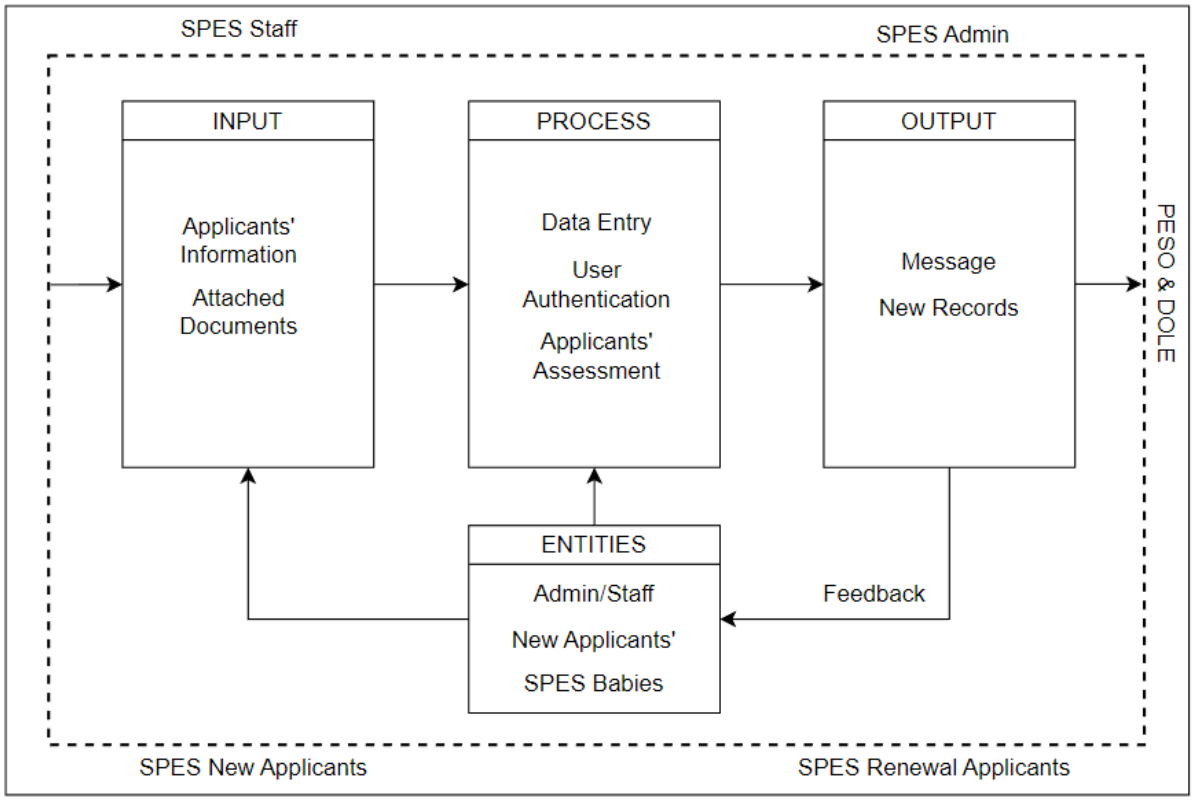

Figure 6. System Boundary

The eSPES Management System was constructed to perform efficiently in the face of several potential obstacles and challenges since it was intended for real-world accrediting procedures. Similarly, researchers believed that what happened outside of the system, in the system's environment, was critical.

Hardware Requirements

Hardware specifications were used to describe the conditions under which a device might access a system. The tables of minimal internal and external hardware requirements for the applicants and their users are shown in Table 1.

Table 1. **User Minimum Internal Hardware Requirements**

Name of Internal Hardware	Specification
Hard Disk Drive	500GB
Processor	Intel Pentium (Dual Core or Third Gen Processors)
Random Access Memory	4GB - 8GB (desktop and laptop users)
Android 10	Qualcomm SDM439 Snapdragon 439 (12 nm) CPU Octa-core

Table 1 listed the minimum internal hardware requirements together with the intended specification requirements, which helped with the system's development. To make sure that the system's behavior was effective and efficient, these requirements were applied in the design process.

Table 2. User Minimum External Hardware Requirements

Name of External Hardware	Specification
Mouse	Any optical mouse; Or trackpad for a laptop
Monitor	720p with 60Hz refresh rate
Keyboard	Any type of keyboard or built-in; keyboard for a laptop

Table 2 listed the necessary specs for the external hardware, including the minimum requirements for the External Hardware, including the mouse, keyboard, and monitor together with its desired specifications. The mouse and keyboard were external hardware that were used by laptop or computer users to fill out the registration form for the applicants and manage applicants' data for the administrator.

Software Requirements Specification

As the accreditation system required specific specifications for functions, procedures, and data storage, software requirements specifications were categorized into functional requirements and non-functional requirements. Other requirements included the programming languages to be used as well as the knowledge of the end user's familiarity with the system. Specifically, the researchers concentrated on the requirements specification of information related to the evaluation process employed for the SPES program since these were critical determinants within the management of data of the SPES applicants.

Software Requirements

The minimum software specifications needed by its applicants and their users to access the system were listed in Table 3. The researchers strongly advised the administrator and the applicants to use the Software Windows Operating System to fully operate and maintain the system.

Table 3. User Minimum Software Specification

Name of Software	Specification
Operating System	64-bit or 32-bit Windows 7 and above; Android 7 +; iOS 12.4.7
Web Browser	Any type of browser

In Table 3 Minimum Software Specification, the intended operating system specification was crucial for the creation of the system since it affected how the system functioned and the efficiency of its functions. Additionally, it was important to have

considered the web browser's characteristics because the built system operated in a variety of browsers and offered users registration and renewal services.

Functional Requirements

This part included the functional requirements that specified the tasks and actions that the system performed. In other words, it provided an overview of the system's features and services. The capabilities found during the planning phase were directly translated into the functional requirements.

1. **Admin**

   1.1 The admin shall be able to search for specific applicants.

   1.2 The admin shall be able to delete applicants' data.

   1.3 The admin shall be able to review the applicants' data.

   1.4 The admin shall be able to evaluate the passed requirements.

2. **New Applicants**

   2.1 The applicant shall be able to view or access the user manual.

   2.3 The applicant shall be able to fill up the registration form to apply.

   2.3 The applicant shall be able to upload the required documents.

3. **Renewal Applicants**

   3.1 The renewal applicants shall be able to view and access the user manual.

   3.2 The renewal applicants shall be able to fill up the registration form to renew their existing record for employment.

   3.2 The renewal application shall be able to upload the required documents.

Non – Functional Requirements

To verify its ability to meet users' needs, the system also took into account additional non-functional requirements.

1. **Accessibility**
    1.1 The system must be accessible from any place with an Internet connection and authorized to access the system.
2. **Accuracy**
    2.1 To provide reliable graphical analysis, the system must have the proper formulae.
3. **Compatibility**
    3.1 The system must be able to function effectively even when using a mix of browsers and operating systems.
    3.2 The system must check whether a web application operates on all versions of different browsers.
4. **Performance**
    4.1 The web-based application must be able to function without any service interruptions and without having to wait for it to finish an action.
    4.2 Each time the system is turned on, all of its features must be accessible to the user.
5. **Reliability**
    5.1 The system must include an online approval guide that will serve as a comprehensive technical communication tool for a wide range of users.

5.2 The generated reports must be accurate and all information must be present in the system exactly as it is.

6. Security

6.1 To prevent any illegal access to the system's data, the system must be able to offer the user a password-protected login.

7. Usability

7.1 The system must be accessible online, and visitors who are not signed up are not permitted to use the website.

7.2 Users can navigate the system's menus with ease thanks to its simple-to-understand buttons.

Constraints

The accompanying tables cover the numerous software design limitations, whereas ratings were decided by self-directed and purposeful participation in analyzing and critiquing each choice based on the researcher's experience and prior knowledge.

Table 4. Server–Side Scripting Languages

Design Constraints	JavaScript	CSS	PHP
Performance	8	8	9
Dependability	8	7	9
End User Criteria	7	8	8
Reliability	8	6	9
Usability	7	7	10
Availability	7	9	9
Security	9	8	8

In terms of server-side scripting tools, the researchers had come up with three options, namely JavaScript, CSS, and PHP, as shown in Table 4. As the researchers had sufficient knowledge to operate and control PHP, it was chosen as the server-side scripting language. Furthermore, the researchers believed that it would be quite useful in creating a dynamic and interactive web page because it could communicate with MySQL databases, among other options.

Table 5. Database

Design Constraints	MySQL	Oracle
Performance	9	8
Dependability	8	8
End User Criteria	9	7
Reliability	9	8
Usability	9	6
Availability	8	8
Security	9	9

As indicated in Table 5, the database options by the researchers included MySQL, MS Access, and Oracle. The aforementioned databases were rated based on the resources about PHP. As a result, MySQL was selected by the researchers since it had a sufficient database server for querying data. Aside from that, it also worked on any operating system and supported a wide range of development interfaces, specifically PHP. MySQL and Oracle, in contrast to MS Access, both had a login and password, making them more secure and reliable. MySQL and Oracle were available on a wide range of systems. MS Access, on the other hand, was solely available for Windows. While Oracle had many

features, MySQL had several advantages that Oracle did not, and it had higher functional performance, therefore it was the most used database.

Table 6. Text and Image Editor

Design Constraints	Notepad	Sublime Text	VS Code
Performance	7	8	9
Dependability	7	8	9
End User Criteria	8	7	8
Reliability	7	7	8
Usability	8	8	8
Availability	7	7	8
Security	6	6	9

Distinctive text and image editors like Notepad, Sublime Text, and Visual Studio Code were shown in Table 6. Although Sublime Text had more advantages than Notepad as it had higher functional performance, the researchers concluded that both text and image editors had plugins and extensions that could be a bit difficult to install, and some of them could be buggy, based on their experience with text editors. Visual Studio Code, on the other hand, had a fast source code editor that was qualified for immediate usage. Moreover, with support for hundreds of languages, VS Code constantly helped the researchers to be instantly productive with syntax highlighting, bracket-matching, auto-indentation, box-selection, snippets, and more. Relative to this, the researchers favored Visual Studio Code due to prior experiences.

Multiple Designs

The eSPES: Online Registration and Data Management System primarily comprised database-driven modules to collect and manage applicants' data, as well as the documents needed by the identified users, such as new applicants and renewal applicants. To support each user type, seven system modules were created for the accreditation system, and these were presented through a Block Diagram in Figure 7.

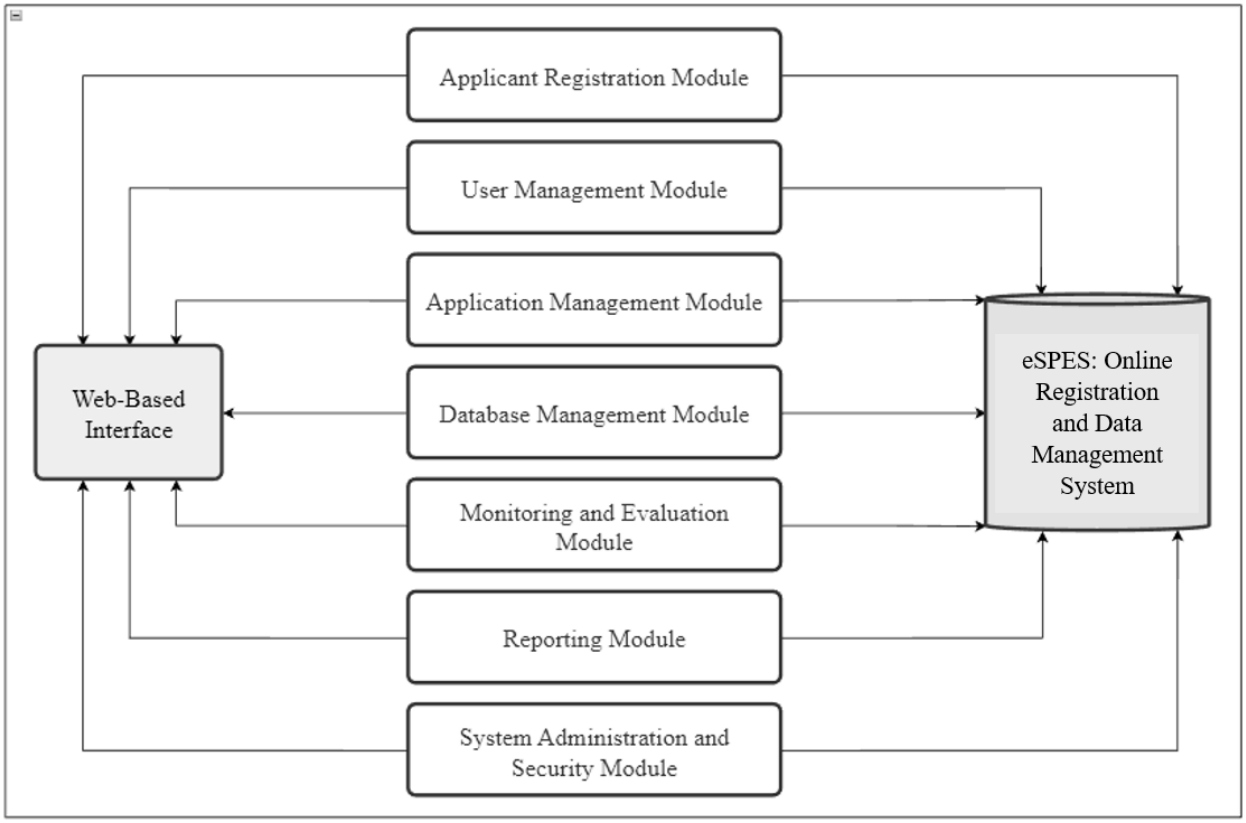

Figure 7. System Modules

The online registration system has six modules. Each module is created and designed according to the functions described:

1. *Applicant Registration Module* - allows new applicants to register for the program, and capture personal details, contact information, and other relevant data.

2. *User Management Module*. This module is responsible for managing applicants' accounts, authentication, and authorization. It allows the system admin/staff to create and manage applicants' accounts and roles, and control access to system features and data.
3. *Application Management Module*. This module is responsible for managing the SPES application process, from application submission to approval, and managing the data of applicants.
4. *Database Management Module*. This module is responsible for managing the system's database, including data storage, retrieval, and manipulation. It includes features such as data backup, data security, and database maintenance.
5. *Monitoring and Evaluation Module*. Monitors the program's performance, tracks the number of beneficiaries and job placements, and generates reports on program outputs and outcomes.
6. *Reporting Module*. This module is responsible for generating reports and analytics on the system's usage and performance. It includes features such as data visualization, report generation, and report sharing.
7. *System Administration and Security Module*. Manages the system's overall performance, ensures system security and data privacy, and provides technical support to users

Trade-off

The analysis of trade-offs throughout the study was one of the major issues that the researchers prioritized to attain competitive objectives and further invested resources

to increase performance. Various halo effects were also implicated since they related to cognitive biases that a researcher possessed directly or indirectly, and how the overall perception of the researcher influenced decision-making. As a result, the sets of designs and their accompanying technological stack were shown in Table 7.

Table 7. Multiple Technology Stacks

Design	Technology Stack
Design A	HTML, CSS, PHP, MySQL, XAMPP
Design B	JavaScript, HTML, Oracle, MAMP

Based on the context shown in Table 7, Design A was composed of open-source solutions that could have been used to develop the accreditation system. Design B, on the other hand, included an alternative option as it had JavaScript that changed the appearance of web pages and was dynamic. The researchers believed that it was a true all-rounder among the most popular programming languages.

Although all of the mentioned alternatives would have been greatly beneficial for the development of the web system, the researchers believed that Design A was the most efficient to use since the researchers were most familiar with the various technology stacks mentioned.

System Design/Architecture

To map out the flow of information through symbols for the accreditation system, Figure 8 depicted the functions or processes that collected, altered, stored, and transferred data between a system and its environment, as well as between system components, were visually represented.

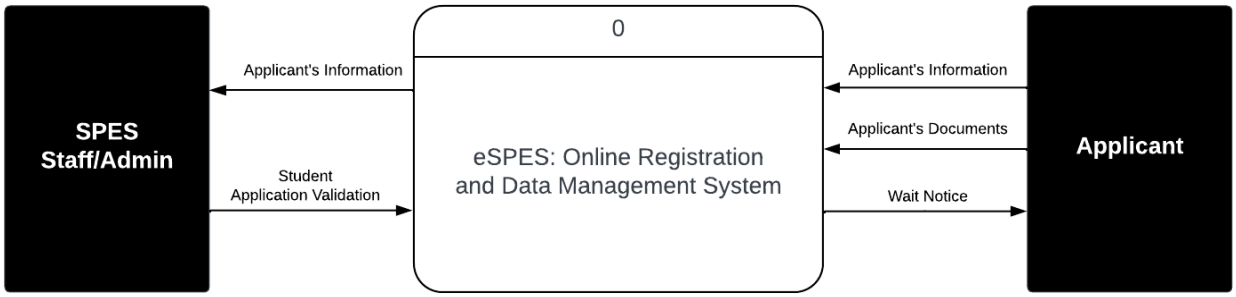

Figure 8. Context Diagram

Based on Figure 8, the eSPES: Online Registration and Data Management System refered to the system under consideration as a single high-level process. Also, the relationship that the system has with external entities such as SPES Staff/Admin and Applicants which includes New Applicants and Renewal Applicants. The SPES Admin retrieved data from the system which is the applicant's information originally entered by the other entity, the applicant. Another input that the applicant entity sends to the system is their required documents which was also retrieved by the admin from the system for further processing and application verification. Moreover, the applicant was to receive the wait notice that was accessible in the system.

Use Case

The use case diagram summarized the relationship between the system's actors and its characteristics, including the examples that were shown in Figure 9.

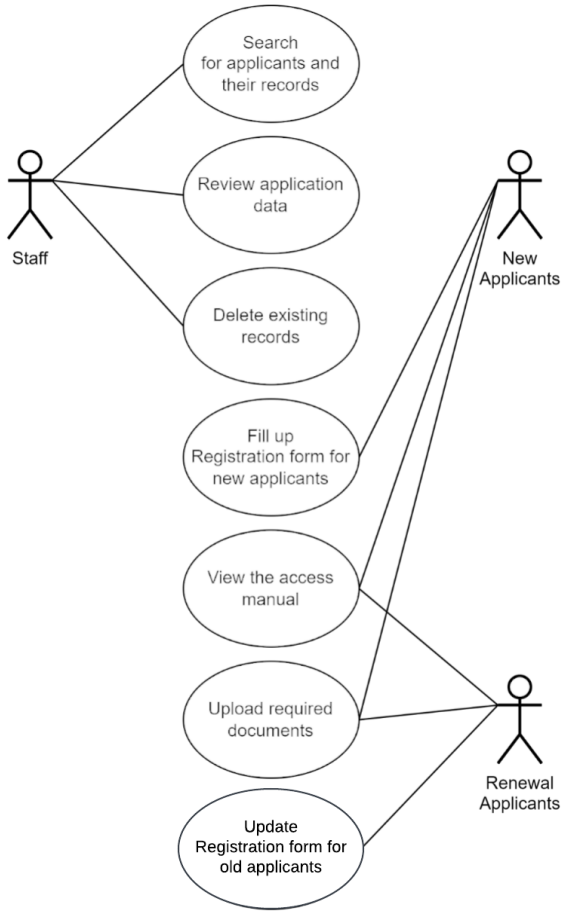

Figure 9. Use Case Diagram

The case diagram for the created system was shown in Figure 9, and a summary of the information for the actors, the admin and applicants, was provided. It showed which interactions each of the actors in the graph could potentially have. Using the system, the staff was able to search for applicants and their records and review their submitted application. The staff have access to delete existing records that are irrelevant and not needed in any further process. On the other hand, The applicants have access to the user manual provided and upload the required documents for the application process. Furthermore, the new applicants can fill up the registration form dedicated for new

seekers and the renewal applicants or old applicants were able to update the existing record entered previously for renewal.

Sequence Diagram

Figure 10 depicts an interaction diagram that explains how the access in the accreditation system - what communications are sent and when - would be implemented.

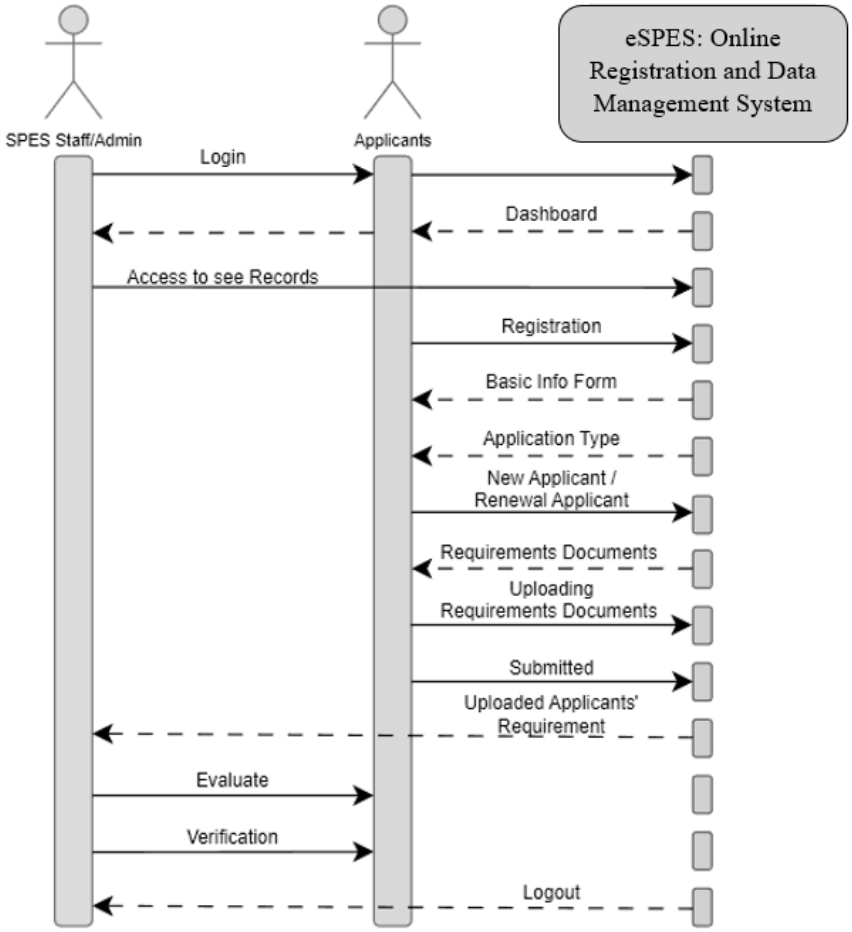

Figure 10. Sequence Diagram

The sequences were ordered according to the time when a user navigates a website, according to Figure 10. Furthermore, the objects engaged in the procedure, such

as Staff and Applicants, were listed from left to right about when they would participate in the message sequence.

Database Design

Figure 11 depicts the data that must be processed as well as the relationships between these data pieces.

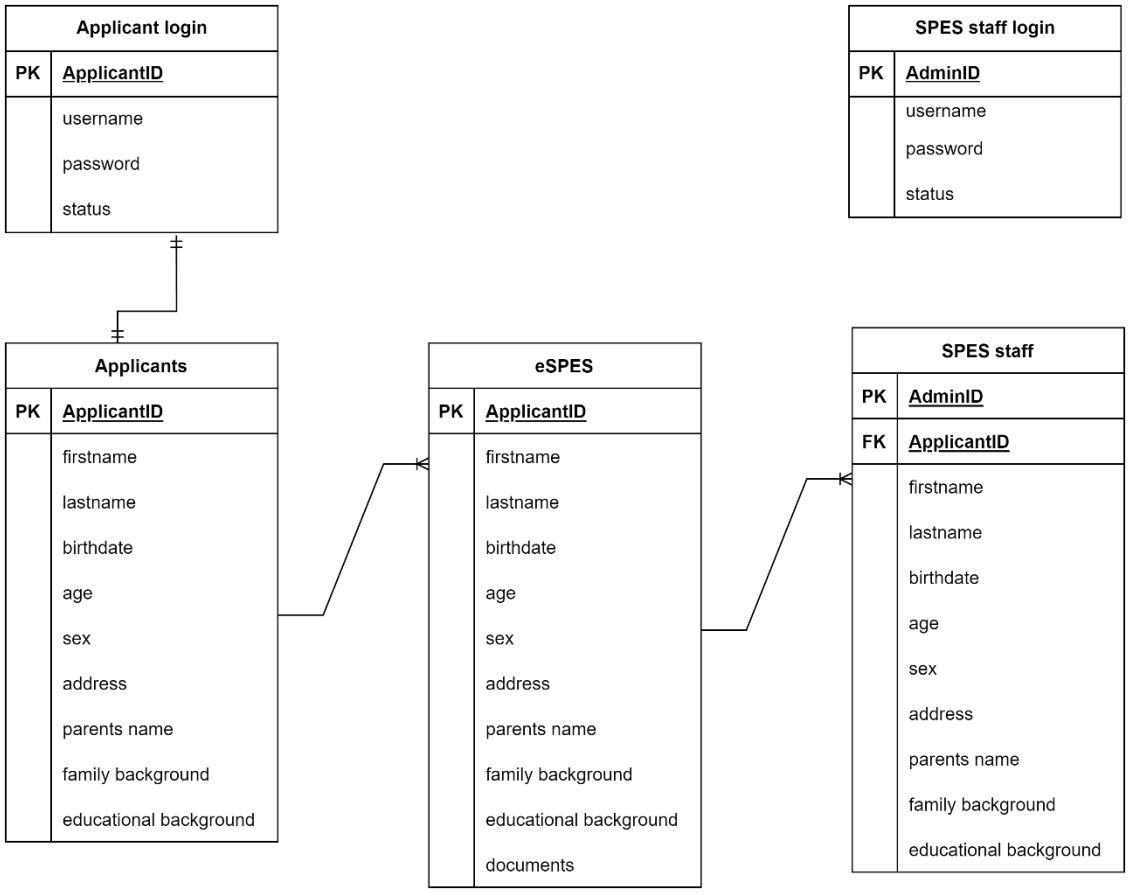

Figure 11. Entity Relationship Diagram

It acted as a template for implementing data in specific software applications, whereas the ER diagram provides the researchers with a better understanding of the information to be stored in the database.

Software

The Online Registration and Data Management System was developed using several software technologies. The back end of the system was built using a popular PHP web application framework known for its simplicity and scalability. The front end was developed using HTML, and CSS for building user interfaces.

In addition, the system used several software tools such as Apache web server, MySQL database management system, and a cloud platform that ensured reliability, security, and scalability. These technologies were selected carefully to meet the requirements of the system and ensured its optimal performance.

Web Platform

The web platform of the Online Registration and Data Management System is a cloud-based system that utilizes web services which provided a centralized platform for managing the application process of Special Program for Employment of Students (SPES) applicants. The system allowed applicants to submit and track their applications online, while authorized personnel reviewed and managed the applications from a single interface. The web platform was built using open-source technologies such as PHP and MySQL and is deployed on a cloud hosting service.

Database

MySQL Server was chosen as the Back-end Technology not only because it is meant to act as a server in a client/server network, but also because it can function as a stand-alone database directly on the client. Similarly, MySQL Server's scalability and

ease-of-use characteristics enabled it to function quickly on a client without requiring excessive resources.

Subscription

Identified in Table 8 is the Software as a Service (SaaS) that the researchers subscribed to gain access to products or services. In particular, website domain pertains to the unique address that users see in the address bar of the browser whereas website hosting is a term subscription that keeps the website accessible on the internet.

Table 8. Subscription Fees

Software as a Service (Saas)	Description	Estimated Cost
Website Domain	The identification string within the Internet	₱ 2,000.00
000webhost	This term subscription would keep the website accessible on the Internet	₱ 3,000.00 per year Total: ₱ 5,000.00

Testing

Although the quality approach was the cornerstone of an item's quality assessment framework, it was used to determine which quality attributes were included when evaluating the properties of a software product. In this light, researchers saw ISO/IEC 25010 as an excellent framework to establish software metrics crucial for the certification system, as it included the eight quality attributes that an excellent system must have.

Testing Procedure

To check whether the system matches the expected requirements, typically involved the following steps:

1. **Unit Testing**. This involved testing individual components of the system to ensure they function correctly and as intended.
2. **Integration Testing.** This is the process of testing the integration of the individual components that ensured they work together as a complete system.
3. **System Testing.** This involved testing the system as a whole, including its interface, functionality, and performance, and ensured that it meets the specified requirements.
4. **Acceptance Testing.** This is the process of testing the system with end-users that ensured it meets their needs and requirements.
5. **Regression Testing.** This involved re-testing the system after changes or updates were made to ensure that the changes did not introduce any new issues or bugs.
6. **Performance Testing.** This involved testing the system under load to ensure that it can handle a high volume of users and transactions.
7. **Security Testing.** This involved testing the system for potential security and ensuring that it is secure from external threats.
8. **Usability Testing.** This involved testing the system's ease of use and ensured that it is intuitive and user-friendly for the intended users.
9. **Compatibility Testing.** This involved testing the system's compatibility with different hardware, software, and operating systems.
10. **Recovery Testing.** This involved testing the system's ability to recover from failures, such as power outages or system crashes.

In addition, the testers examined how secure the system was against internal and external threats. Testing of how safe and robust the authorization and authentication processes are, as well as how the software responded in the face of any attack and harmful programs, were included. Similarly, the testers assured that the system works with a variety of browsers and operating systems.

Data Gathering

The data gathering process for the Online Registration and Data Management System involved several methods such as interviews, surveys, and document analysis. The researchers conducted interviews with key stakeholders such as SPES coordinators, program supervisors, and applicants and gathered their insights and feedback. Document analysis was conducted to review existing literature, policies, and procedures related to the SPES program.

Deployment

The deployment process made the system available and operational to the end-users. It included activities such as system installation, configuration, and testing that ensured the system was functioning as expected in the production environment.

The deployment process was done in various ways such as manual deployment, automated deployment, and hybrid deployment, depending on the system's complexity and requirements. It is important that proper deployment procedures were followed and conducted thorough testing to ensure that the system is stable, reliable, and secure for end users.

Table 9. Deployment Process Activities

Activities	Development	Testing	Deployment	Maintenance
DP 1: Define/ continuously redefine the scope and content of the release				
DP 2: Determine the type of release				
DP 3: Create a deployment team				
DP 4: Develop installation procedures				
DP 4.1: Develop rollback procedures				
DP 4.2: Develop installation manuals				
DP 4.3: List organization and stakeholders affected by the new release				
DP 4.4: Prepare release and develop documentation				
DP 4.5: To establish or regularly modify the access rights required to release the components.				
DP 5: Installation				
DP 5.1: Create a backup of the system release to be de-installed				
DP 5.2: Conduct a deployment readiness test.				

DP 5.3: Distribute and deliver the system and/or system components at the correct location and time.				
DP 5.4: Install the new system version.				
DP 5.5: Install operational data.				
DP 5.6: Document any incidents, unexpected events, issues, or deviations from the release plan.				
DP 5.7: Perform deployment certification test.				

Maintenance

The maintenance of the study involved regular updates, bug fixes, and system improvements to ensure optimal performance and availability. This included monitoring the system's performance, identifying and addressing any technical issues, and ensuring data security and privacy.

The effective maintenance was achieved by performing the following tasks regularly.

1. Regular system backups to ensure that data is not lost in case of system failure or data breaches.
2. Regular updates and patches to address security vulnerabilities and improve system functionality.

3. Monitoring system performance, including response times, resource utilization, and error rates.
4. Conduct regular security audits to identify and address any security threats or vulnerabilities.
5. Providing user support and training to ensure that users can effectively use the system and troubleshoot any issues they may encounter.
6. Continuously evaluate the system's performance and user feedback to identify areas for improvement and ensure that it remains relevant to the needs of its users.

By following these maintenance practices, the Online Registration and Data Management System continued to provide reliable and efficient services to its users.

Table 10. Maintenance Plan

System	Maintenance Type	Time Interval	Assigned Researcher
eSPES: Online Registration and Data Management System	Adaptive	Monthly	Ian Kevin P. Lising
	Corrective	Weekly	Princess Catherine A. Mendoza
	Preventive	Quarterly	All Resesarchers
	Perfective	Monthly	Niña Claire Alejandra V. Merhan

The initial context in which the program was produced (operating system, certification process and guidelines, and exterior characteristics) is likely to change over

time. The researchers of the study included adaptive maintenance to adjust the program to suit changes in its external environment. Similarly, corrective maintenance altered the program to address flaws.

In the alternative, when the program was utilized, the staff and applicants noticed more functionalities that were useful. In comparison, perfective maintenance expanded the program beyond its initial function requirements. Finally, computer software degraded due to change, and as a result, preventative maintenance, also known as software re-engineering, ensured that the program continues to meet the demands of its end users. In simple terms, preventive maintenance modified computer programs and made them more readily fixed, adapted, and upgraded.

Approximately around 15% - 20% of all maintenance effort was spent "fixing mistakes." The remaining 80% - 85% was spent on adapting current systems to changes in their external setting, implementing user-requested modifications, and reengineering a program for usage.

Risk Management

Risks were potentialities that, when transformed into reality in a project management setting, were regarded as concerns that had to be handled efficiently. As a result, detecting, assessing, followed by responding to any risk that developed over the course of a project's life cycle was critical to ensure that the project stayed on track and met its objectives. Risk analysis and management were utilized as a major project management strategy throughout the research to guarantee that there were as few surprises as possible while the project was underway.

Although prospects could never have been predicted with precision, a simple and simplified risk management strategy for predicting project uncertainties and minimizing the incidence or effect of these uncertainties might have significantly influenced the entire project. Furthermore, this would have increased the likelihood of completing the project successfully and decreased the implications of those risks.

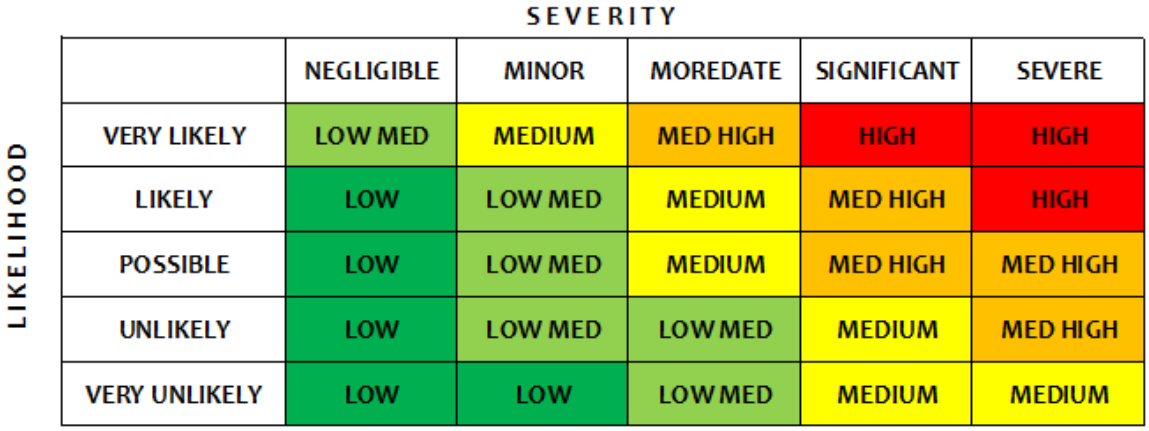

Figure 12. Risk Matrix

To further classify and elaborate on the aforementioned risks, illustrated in Figure 12 is the Risk Matrix which served as the basis for risk analysis presented in Table 11.

Table 11. Risk Analysis

ID	RISK	Category	Likelihood	Severity	Impact
001	Security breaches or data loss	Technical	Unlikely	Significant	Medium
002	System downtime	Technical	Possible	Minor	Low Med
003	Dependency on third-party vendors	External	Possible	Negligible	Low
004	Compliance and regulatory issues	External	Possible	Minor	Low Med
005	Cost overruns	External	Likely	Minor	Low Med
006	Internet Interruption	External	Likely	Significant	Med High

007	Human Error	Technical	Likely	Minor	Low Med
008	Data Leakage	External	Likely	Significant	High
009	Slow Response Time	Technical	Very Unlikely	Severe	Medium

With this, the researchers identified nine risks that tremendously affect the system:

RISK 001: Security breaches, or data loss. There is a risk of data breaches or loss due to unauthorized access, hacking, or technical errors. Such incidents could compromise the sensitive data of the applicants, such as personal information and financial details.

RISK 002: System downtime. The cloud-based system could face downtime due to technical glitches or maintenance issues, causing inconvenience to the applicants and stakeholders.

RISK 003: Dependency on third-party vendors. The system may rely on third-party vendors for cloud hosting or web services, which could introduce additional risks such as vendor lock-in, limited control over service quality, and compatibility issues.

RISK 004: Compliance and regulatory issues. The system should comply with relevant laws and regulations, such as data privacy laws and labor regulations, which could pose challenges if not properly addressed.

RISK 005: Cost overruns. Implementing and maintaining a cloud-based system involves costs such as hardware, software, licensing, and subscription fees. Unanticipated costs or budget overruns could impact the project's viability and sustainability.

RISK 006: Internet Interruption. Internet interruption can affect the proposed Cloud-Based System for SPES Applicants Using Web Services and Database Management by causing downtime or unavailability of the system, which can disrupt the service to the users and stakeholders.

RISK 007: Human Error. Human error can cause data entry mistakes, system misconfigurations, and other errors that could impact the system's performance, data integrity, and security.

RISK 008: Data Leakage. Data leakage, such as unauthorized access or disclosure of sensitive data, can compromise the confidentiality and privacy of the applicants and stakeholders.

RISK 009: Slow Response Time. It can negatively affect user experience and efficiency. It can be caused by various factors such as network latency, system capacity, and database performance.

Table 12. Risk Treatment

Risk	Risk Treatment
RISK 001: Security breaches or data loss	Implement strong authentication and authorization mechanisms, data encryption, and regular data backups to prevent unauthorized access or data loss. Conduct regular security audits and penetration testing to identify and mitigate vulnerabilities.
RISK 002: System downtime	Develop a robust disaster recovery plan and perform regular maintenance and upgrades to minimize the risk of system downtime. Use redundant systems and backup servers to ensure continuity of service.

RISK 003: Dependency on third-party vendors	Evaluate and select vendors carefully based on their reputation, reliability, and security practices. Establish clear service level agreements (SLAs) and monitor vendor performance regularly.
RISK 004: Compliance and regulatory issues	Conduct a thorough legal and regulatory compliance review and ensure that the system complies with all relevant laws and regulations. Stay up-to-date with changes in laws and regulations that may affect the system.
RISK 005: Cost overruns	Develop a comprehensive training program and user manuals to ensure that users are well-equipped to use the system. Conduct regular user feedback surveys to identify and address user concerns and improve the user experience.
RISK 006: Internet Interruption	To mitigate this risk, redundancy can be built into the system by having multiple internet service providers and failover mechanisms in place.
RISK 007: Human Error	Proper training, documentation, and quality control measures can help minimize the risk of human error.
RISK 008: Data Leakage	Access controls, encryption, monitoring, and auditing mechanisms can be implemented to prevent and detect data leakage.
RISK 009: Slow Response Time	Performance testing and optimization can help identify and address slow response time issues. Additionally, scalability and resource management can be implemented to ensure the system can handle increased demand and usage.

On the other hand, for all of the risk treatments listed in Table 12, a team member who can best monitor the risk trigger and drive the suggested treatments was chosen.

Table 13. Risk Ownership

ID	RISK	Owner
001	Security breaches or data loss	Ian Kevin P. Lising
002	System downtime	Niña Claire Alejandra V. Merhan
003	Dependency on third-party vendors	Ian Kevin P. Lising
004	Compliance and regulatory issues	Niña Claire Alejandra V. Merhan
005	Cost overruns	Princess Catherine A. Mendoza
006	Internet Interruption	Niña Claire Alejandra V. Merhan
007	Human Error	Princess Catherine A. Mendoza
008	Data Leakage	Ian Kevin P. Lising
009	Slow Response Time	Princess Catherine A. Mendoza

As a result, risk owners, as shown in Table 13, were assigned to report any changes immediately and to drive the recommended procedures.

APPENDIX A

SCHEDULE AND TIMELINE

Figure 13 depicts an activity schedule as well as supporting information such as important dates, length, and the individuals involved in the specific work. This chart made it simple to assign tasks to various team members and organize team resources without overloading staff.

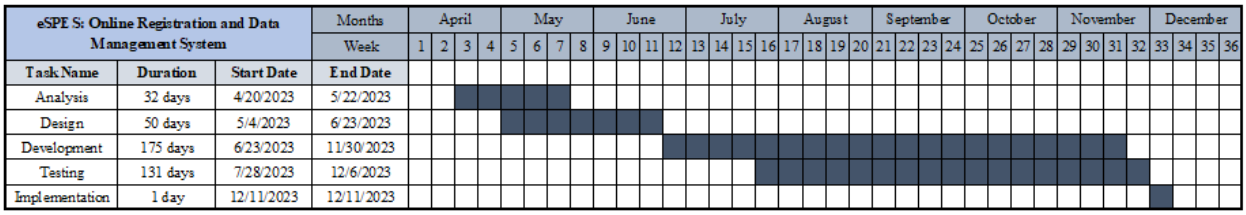

Figure 13. Gantt Chart

Furthermore, this study's project management was divided into six phases: analysis, design, development, testing, implementation, and maintenance, with each phase viewed as an application of knowledge, skills, tools, and techniques to a wide range of activities to meet the project's objectives by the study's researchers.

APPENDIX B

PROJECT ROLES AND RESPONSIBILITIES

Table 14 depicts the researchers' involvement throughout the investigation. As a result, the researchers worked effectively on the study, and each researcher is versed in a variety of disciplines and boasts a certain skill set.

Table 14. Roles and Responsibilities

Name of the Proponents	**Task/Responsibility**
Ian Kevin P. Lising	Lead Programmer, Documentation
Princess Catherine A. Mendoza	UI/UX Designer, Documentation
Niña Claire Alejandra V. Merhan	Documentation, Quality Assurance Tester

Table 14 shows the project team and their responsibilities. The group has three members; Ian Kevin P. Lising is the lead programmer and contributed with the documentation, while Princess Catherine A. Mendoza and Niña Claire Alejandra V. Merhan are assigned with UI/UX Design, Documentation, and Quality Assurance respectively. Additionally, they were also responsible for the analysis and research of information.

On the other hand, Ms. Mendoza and Ms. Merhan were responsible for creating new ideas or supporting the documentation while simultaneously ensuring that the software solution satisfies the business requirements and is free of bugs, errors, and flaws.

APPENDIX C

BUDGET COST MANAGEMENT PLAN

Presented in Table 15 is the budget cost management plan for the web system.

Table 15. Budget Cost Management Analysis

CATEGORY	YEAR			
	0	1	2	3
INITIAL INVESTMENT	₱ 9,500			
Development	₱ 5,000			
Hardware	₱ 1,500			
Software	₱ 2,000			
Operating Cost and Fixed Equipment	₱ 1,000			
ADDITIONAL COST		₱ 13,000	₱ 13,700	₱ 14,000
Project Management		₱ 5,000	₱ 5,000	₱ 5,000
Client Support		₱ 1,000	₱ 1,200	₱ 1,500
Maintenance		₱ 2,500	₱ 3,000	₱ 3,000
Domain		₱ 1,500	₱ 1,500	₱ 1,500
Hosting		₱ 3,000	₱ 3,000	₱ 3,000
BENEFITS		₱1,500	₱1,500	₱ 2,000
Reduction in Travel		₱ 1,500	₱ 1,500	₱ 2,000