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DEVELOPMENT OF A WEB-BASED ERP INTEGRATED MANAGEMENT SYSTEM AND DECISION SUPPORT FOR DUV ENGINEERS WITH MOBILE APPLICATION

A **Capstone Project**

Presented to the Faculty of

Computer Studies Department

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by

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Chapter 1

THE PROBLEM AND ITS BACKGROUND

Introduction

The construction industry plays a vital role in economic growth by developing infrastructure, generating employment, and advancing technologies. However, this industry faces constant challenges in managing projects, resources, and operations efficiently, especially with the increasing demand for complex construction works. As technology continues to evolve, digital solutions such as automation, cloud computing, and data analytics have become essential in improving efficiency and accuracy in construction management. Proper project management and resource allocation, supported by modern technological advancements, are crucial to ensuring that projects are completed on time and within budget (Appinventiv, 2025).

DUV Engineers, a Cavite-based structural and civil engineering firm with over 15 years of experience, has served both local and international clients in various sectors. With expertise in structural design, consultancy, and project management, the company has contributed to projects such as commercial buildings, government facilities, and power plants. Over the years, DUV Engineers has continuously provided engineering solutions that prioritize safety, quality, and value. As their operations grow, they face increasing challenges in handling manual processes and managing multiple projects simultaneously.

As the industry grows more competitive, the demand for streamlined processes and integrated systems becomes essential. Enterprise Resource Planning (ERP) systems serve as solutions that combine multiple business functions into a unified platform, allowing real-time data access and efficient project management. ERP systems help businesses monitor resources, track financial activities, manage human resources, and improve decision-making. For a construction company like DUV Engineers, integrating ERP means better control over projects, enhanced communication among teams, and reduced errors caused by manual handling of tasks.

This research focuses on the development of a web-based ERP integrated management system with decision support, specifically designed for DUV Engineers. The researchers aim to create a system that centralizes essential business operations, including financial resource management, supply chain management, human resource management, and customer relationship management. Additionally, the system incorporates a decision support system, which functions as a chat-based support tool to assist clients in estimating construction costs, also a mobile application to enhance accessibility for clients. By integrating these features, the researchers intend to minimize operational inefficiencies, support data-driven decision-making, and improve overall project performance. This ERP system is expected to provide DUV Engineers with a more structured and efficient approach to managing construction projects, aligning with their long-term goals of safety, quality, and cost-effectiveness.

Project Context

The researchers developed an ERP system to help DUV Engineers manage financial resource management, supply chain management, human resource management, and customer relationship management more efficiently. Like many construction firms, DUV Engineers still relies on manual processes and separate systems, which often lead to delays, miscommunication, and inefficiencies. To solve these challenges, the team developed a web-based ERP system with a Decision Support feature and a Mobile Application, bringing all essential business functions into one seamless platform.

The first module is Human Resource Management, which enables the DUV engineers to manage employee records, monitor attendance, process payroll, and workforce productivity. Through real-time data entry by making an automated system, this module automates activities and ensures that HR functions are centralized within the management team.

The next module is Customer Relationship Management (CRM), which improves interaction with clients by making inquiries computerized, managing customer feedback, and ensuring smooth communication between the company and its clients. This module helps DUV Engineers maintain strong client relationships and address concerns efficiently. The system is implemented through a centralized digital platform where client inquiries and feedback are logged, tracked, and managed in real time, ensuring that concerns are addressed promptly.

The system also comes with a Supply Chain Management Module. This feature enables accurate tracking of all construction materials and equipment in real time. This guarantees that project managers can keep track of stock levels to prevent shortages and over-purchasing, thereby optimally managing the supply chain, minimizing waste, and expenses.

The Financial Resource Management module helps track budgeting, spending, and reporting activities as well as support expense tracking. Team is currently responsible for creating daily reports. This module allows for cash flow, project expenditure, and overall financial health to be monitored in real-time.

Decision Support System, this is basically a chat based support system, clients can find out the range of costs for the construction projects that they have in mind. It is able to adapt calculations based on client prompts — like how many square meters they need, or the size of the entire project. It uses these factors to create a breakdown of expenses, thus offering clients control over their economic decisions after making the necessary adjustments. Thus this module is a estimation support tool where the researchers are going to give accurate and flexible assessment of construction costs for planning purposes.

The Mobile Application offers convenient access for engineers to update project progress and engage with clients through chat. Although it has fewer features than the web version, it enhances coordination, enables real-time updates, and streamlines communication between field and office teams.

With the integration of modules, the Decision Support System, and the mobile application, the system aims to reduce inefficiencies, improve communication, and enhance decision-making, ultimately helping DUV Engineers manage construction projects more effectively.

Statement of the Problem

The construction industry struggles with managing projects, resources, and decision-making due to the lack of an integrated ERP system. Many firms, including DUV Engineers, still use manual processes and separate systems for project management, inventory, finances, and workforce coordination. This leads to inefficiencies, miscommunication, delays, and financial issues, affecting overall project performance.

This research aims to address the following questions:

1. How can DUV Engineers improve the operational efficiency and manual processes?
2. What security measures should be implemented to ensure data integrity, system reliability, and secure access to critical project information?
3. What essential features should the system include to ensure accurate, real-time data handling and decision support for construction operations?
4. How can the mobile application component enhance communication, coordination, and accessibility for project managers and field personnel?

5. How effective is the proposed system in minimizing operational inefficiencies and improving decision-making in construction management?

Objectives of the Study

The main objective of this study is to develop and evaluate a web-based ERP integrated management system and decision support for DUV Engineers, aimed at improving operational efficiency, resource management, and project monitoring. The system will streamline key construction processes, enhance real-time data access, and facilitate better decision-making.

1. Develop a unified ERP System integrating project management, inventory tracking, financial reporting, and workforce coordination for DUV Engineers.
2. Develop a secure ERP system with encryption and access control to protect data integrity, ensure system reliability, and provide secure access to management features.
3. Integrate features that enable real-time and accurate data collection, storage, and retrieval across all system modules.
4. Enhance accessibility and communication by implementing a mobile application for project managers.
5. Integrate a decision support system within the ERP system that enhances decision-making, optimizes resource allocation, and minimizes operational inefficiencies in construction management.

Scope and Limitations of the Study

This study focuses on the design, development, and evaluation of a web-based ERP integrated management system and decision support for DUV Construction, including a mobile application. The system will incorporate key modules such as project management, inventory tracking, financial reporting, workforce coordination, and decision support tools to enhance operational efficiency. The primary users will include DUV Construction management, site engineers, project managers, and administrative staff, ensuring seamless project monitoring, resource allocation, financial tracking, and communication among teams. The mobile application will provide real-time access to essential project data. Additionally, the system will feature predictive analytics to support data-driven decision-making and will integrate with third-party financial institutions, payment gateways, and external APIs to facilitate secure transactions and seamless data exchange.

However, this study has certain limitations. The system is specifically designed for DUV Construction, limiting its adaptability to other firms without customization. It will be accessible only through web and mobile platforms, excluding a standalone desktop version. While predictive analytics is included, advanced AI-driven automation will not be part of the system. The accuracy of decision support features will depend on user-provided data, and integration with external financial platforms will be limited to selected providers. Security measures such as encryption and access controls will be implemented, but full compliance with financial and data privacy regulations will depend on external requirements. Additionally, system evaluation will be conducted with a limited number of

users, and budget constraints may affect the initial scope of some features.Furthermore, not all features available in the web application will be present in the mobile application, as some functionalities may be optimized for desktop use only. Despite these limitations, the focus of this study will be on improving operational efficiency through ERP integration, ensuring that the system meets the specific needs of DUV Engineers while providing a scalable foundation for future enhancements.

Significance of the Study

This study aims to develop a web-based ERP integrated management system and decision support for DUV Construction, enhancing efficiency in project management, resource allocation, and decision-making. The system will benefit various stakeholders as follows:

DUV Construction Management and Staff. The result of this study will provide a cost-effective solution to streamline operations, reduce reliance on manual processes, and improve coordination between project managers, site engineers, and field workers.

Construction Workers and Field Personnel. The result of this study will enable real-time access to project updates through the mobile application, reducing delays and improving communication between teams.

Clients and Stakeholders. The result of this study will enhance project tracking and financial management, ensuring more efficient service delivery and better project outcomes.

IT Research and Development. The result of this study will contribute to the field by showcasing the application of web-based ERP systems in the construction industry, providing insights into best practices for system integration.

Researchers. The result of this study will enhance the researchers' knowledge and technical skills in system development, serving as valuable experience for future projects.

Future Researchers. The result of this study will serve as a reference for those who wish to explore ERP system integration in the construction industry, offering insights and potential areas for further improvement.

Definition of Terms

This study operationally defined the following:

Audit Trail. A system feature that records user activities and changes made to project data to ensure accountability and data security.

Automated Notifications. System-generated alerts and reminders for project deadlines, stock shortages, and financial reports.

Chat-Based Support System. A feature in the Decision Support Module and Mobile Application that allows real-time communication between clients and project managers.

Cloud-Based Storage. The system feature that allows project data, financial records, and other critical information to be stored and accessed online.

Compliance Tracking. A feature that ensures all construction projects adhere to legal, safety, and environmental regulations.

Construction Cost Estimation. A functionality within the Decision Support Module that calculates project expenses based on user inputs such as materials, labor, and project size.

Construction Industry. The sector involved in designing, planning, and building infrastructure, including roads, buildings, and other structures.

CRM (Customer Relationship Management) Module. The system feature that helps manage client interactions, inquiries, feedback, and communication between the company and its clients.

Dashboard Analytics. A visual representation of key performance indicators (KPIs) and project insights for better decision-making.

Data Integrity. The accuracy, consistency, and reliability of data stored within the ERP system.

Decision Support System. The chat-based support system that estimates construction project costs based on client inputs such as budget, project size, and materials.

Document Management System (DMS). A module that organizes, stores, and tracks construction-related documents such as contracts, blueprints, and reports.

DUV Engineers. The construction firm for which the integrated ERP system is developed to enhance project management and operational efficiency.

Financial Resource Management Module. The feature within the ERP system that manages budgeting, spending, financial reporting, and expense forecasting to monitor financial health.

HRM (Human Resource Management) Module. The feature in the ERP system that manages employee records, attendance, payroll processing, and workforce productivity.

Mobile Application. The system component is designed to improve communication and accessibility for project managers and field personnel by providing real-time updates and data access.

Operational Efficiency. The ability to complete construction projects using minimal resources while maximizing productivity and reducing delays.

Progress Tracking. A feature in both the web-based system and mobile application that allows engineers and project managers to monitor and update the status of construction projects.

Project Management. The process of planning, executing, and overseeing construction projects to ensure timely completion within budget.

RBAC (Role-Based Access Control). A security measure that restricts system access based on user roles and responsibilities.

Real-Time Data Processing. The ability of the system to update and reflect changes immediately as information is entered.

Scalability. The ability of the ERP system to expand and adapt to future business needs without significant modifications.

Stakeholders. Individuals or groups, such as management, employees, and clients, who are directly affected by the ERP system.

Supply Chain Management Module. The feature within the ERP system that tracks and monitors construction materials and equipment in real time to prevent shortages and over-purchasing.

System Integration. The process of combining different business functions into a single digital platform to enhance workflow and coordination.

System Usability. The ease with which users can navigate and operate the ERP system to perform necessary tasks efficiently.

Task Management. A system function that organizes project activities, assigns tasks to team members, and tracks their completion.

User Authentication. The security feature that verifies the identity of users before granting access to the system.

Web-Based System. A software application that runs on a web server, allowing users to access it through an internet browser instead of traditional desktop software.

Chapter 2

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter presents a collection of relevant literature and studies that provide a strong foundation for the DUV Construction ERP Integrated Management System with Mobile App. It explores various research works on Enterprise Resource Planning (ERP) systems and their impact on construction project management, resource allocation, and overall efficiency. The discussion covers key areas such as project completion challenges, ERP integration in different industries, and modern approaches to improving construction workflows.

By reviewing these studies, this chapter helps establish the significance of the research, showing how ERP systems have been successfully implemented in different settings and how they can address common problems in construction management. The insights gathered from these studies highlight existing gaps in traditional project management methods and emphasize the potential benefits of adopting digital solutions.

The literature included in this chapter was carefully selected to ensure its relevance to the study's objectives. By analyzing previous research, this chapter strengthens the justification for developing a construction-focused ERP system, demonstrating how it can improve project execution, minimize delays, and enhance decision-making for construction firms.

Local Literature

According to Pascua and Fernando (2025), various factors impact project completion timelines in the private construction sector in San Mateo, Isabela. Their study identified key causes of project delays, such as ineffective scheduling, poor resource management, and unforeseen site conditions. To address these challenges, the research highlighted the necessity of a holistic construction management approach, advocating for the use of digital solutions like Enterprise Resource Planning (ERP) systems. By integrating real-time project tracking, task automation, and data analytics, ERP platforms can greatly enhance operational efficiency, strengthen project oversight, and ensure timely project completion. This study aligns with the objectives of the proposed DUV Construction ERP Integrated Management System with Mobile App, which aims to tackle similar inefficiencies in construction operations. Through the adoption of digital solutions, the system will improve scheduling, optimize resource allocation, and enable real-time tracking, ultimately minimizing project delays and enhancing overall construction workflows.

According to Pabustan et al. (2021), Enterprise Resource Planning (ERP) systems significantly enhance operational efficiency by improving tracking, monitoring, planning, and resource management. Their study highlighted that ERP implementation leads to increased productivity, reduced operational costs, minimized waste, and optimized workflows. Additionally, ERP systems facilitate better decision-making by providing real-time data access, ensuring seamless coordination among departments, and improving overall business performance. These findings align with the objectives of the DUV

Construction ERP Integrated Management System with Mobile App, which aims to streamline construction processes through real-time tracking, task automation, and resource optimization. By integrating ERP-driven methodologies, the proposed system seeks to improve project execution, enhance project monitoring, and mitigate delays caused by inefficient resource allocation. Furthermore, the system will contribute to better financial management, improved communication among project teams, and enhanced workflow automation—key factors in ensuring efficient project completion in the construction industry.

According to Dela Cruz and Santiago (2022), the integration of mobile applications in construction site management has transformed project monitoring and workforce coordination in various private firms in Cebu. Their research emphasized that mobile apps provide real-time updates, facilitate on-site reporting, and streamline communication between field engineers and project managers. The study revealed that mobile technology enhances project transparency, reduces operational bottlenecks, and ensures faster resolution of site issues. This aligns with the DUV Construction ERP Integrated Management System with Mobile App, which leverages mobile accessibility for efficient tracking, remote collaboration, and instant project updates, thus improving overall site management.

According to ANSI Information Systems (2023), ERP systems have significantly improved business management capabilities within the Philippine construction industry. The study highlights that the adoption of ERP solutions enhances project planning, optimizes resource management, and boosts overall operational efficiency. By integrating real-time

data tracking, automated workflows, and financial management tools, ERP platforms help construction firms reduce inefficiencies, improve communication, and ensure project completion within deadlines. This aligns with the objectives of the proposed DUV Construction ERP Integrated Management System with Mobile App, which aims to streamline project tracking and decision-making processes. Through ERP adoption, construction companies can experience better coordination among departments, enhanced financial reporting, and a data-driven approach to managing projects.

According to Santos (2024), the adoption of modern technologies has significantly influenced the Philippine construction industry by enhancing operational efficiency, improving resource management, project planning, and decision-making processes. The study highlights that technology-driven solutions enhance operational efficiency, optimize resource allocation, and reduce human errors, which are critical factors in managing large-scale construction projects. This aligns with the objectives of the proposed DUV Construction ERP Integrated Management System with Mobile App, which aims to enhance decision-making through a Decision Support System. By incorporating real-time data analysis and predictive insights, construction firms can make informed decisions regarding project timelines, budgeting, and resource allocation, ultimately minimizing inefficiencies and improving project outcomes.

Foreign Literature

According to Vararean-Cochisa and Crisan (2024) conducted an integrative review of digital transformation (DT) in the construction industry using the CIMO framework to analyze 15 case studies. They identified strong management support, a digital-focused culture, and evolving customer expectations as key drivers of successful DT. Essential interventions included Building Information Modeling (BIM), cloud computing, and the Internet of Things (IoT). The study categorized DT into three maturity levels—traditional, niche, and advanced—emphasizing benefits such as cost accuracy, efficiency, quality improvement, and competitive advantage. This supports the need for a customized ERP-integrated management system for DUV Construction, prioritizing resource management and financial control over full automation to better meet the needs of Philippine construction firms.

According to FPT Information System (2023) explored the application of Enterprise Resource Planning (ERP) systems in the construction industry, emphasizing their role in addressing key operational challenges. The study identified fragmented project data, inefficient resource allocation, and financial mismanagement as critical issues that hinder project efficiency. By integrating business processes into a centralized system, ERP solutions provide real-time data access and automated workflows, aiding in reducing project delays and cost overruns. While internationally, ERP systems focus on high-tech automation for large projects, local Philippine firms contend with budget and infrastructure limitations, necessitating adapted solutions. The methodologies employed globally align with the

theoretical framework for DUV Construction's proposed management system, aiming for cost-effective and scalable solutions that tackle manual inefficiencies rather than undergo large-scale digital transformations.

According to Patil and Raut (2022) conducted a literature review on challenges faced during and after ERP system implementation, analyzing 20 research articles. They identified conflicts between parent companies and subsidiaries in multinational enterprises (MNEs), where parent companies prefer standardized ERP systems for control, while subsidiaries favor localized processes for operational efficiency. The study emphasized the need for further research to address these conflicts and enhance ERP implementation strategies. It also highlighted that while standardized ERP systems offer benefits for global corporations, localized approaches might be more effective for addressing region-specific needs, advocating for flexible ERP frameworks that balance global integration with local adaptability.

According to Fallahpour et al. (2020), the integration of fuzzy decision-making models into construction project selection enhances sustainability by accounting for various uncertainties and complex factors. The study presents a fuzzy decision support system (FPP-FIS model) to evaluate and prioritize construction projects based on multiple criteria. This approach supports decision-makers in selecting the most sustainable projects, aligning with DUV Engineers goals of optimizing project selection and management through data-driven systems.

According to Galjanić et al. (2022), a bibliometric study was conducted on 750 papers related to decision support systems (DSS) in construction projects, focusing on project success, optimization, and performance. The study highlights that the construction industry remains one of the least digitized sectors, with a growing need for organizational changes to incorporate digital technologies. These technologies, particularly DSS, can address critical issues such as project delays, cost overruns, and safety concerns. The study also emphasizes the importance of digital technologies to improve decision-making processes in construction projects, aligning with the theoretical framework for DUV Construction's proposed management system, which aims to tackle inefficiencies in project management by incorporating DSS for optimized outcomes.

Local Studies

According to Reyes and Bautista (2023), the implementation of Decision Support Systems (DSS) in construction project management has significantly improved decision-making efficiency among contractors in Metro Manila. Their study highlighted how DSS platforms, integrated with real-time analytics and predictive modeling, assist project managers in resource allocation, risk assessment, and scheduling. The findings suggest that DSS adoption minimizes human error, enhances data-driven strategies, and accelerates decision-making processes. This study supports the objectives of the proposed DUV Construction ERP Integrated Management System with Mobile App, which incorporates DSS functionalities to provide construction firms with optimized project execution strategies, ultimately reducing delays and maximizing resource efficiency.

According to Pinlac et al. (2023), the development of the "ConCheck" application enhanced project monitoring for private construction firms in Pampanga by providing real-time tracking of progress, weather conditions, and project delays. The application was designed to improve construction project management by offering structured reports and data visualization tools. Firms that participated in pilot testing reported increased efficiency in monitoring and managing their projects. The study demonstrates the advantages of mobile applications in construction monitoring. However, "ConCheck" primarily focused on tracking and reporting, without incorporating broader ERP functionalities such as financial management, supply chain coordination, and advanced decision support. The present study

builds on this research by integrating a more comprehensive ERP framework with decision-support mechanisms and mobile application features.

According to Alviar et al. (2024), mobile technology plays a critical role in improving project management efficiency within the Philippine construction industry. The study examined how mobile applications enable real-time communication, tracking of project schedules, and resource monitoring among engineers, contractors, and project managers. The proposed mobile platform provided seamless collaboration and improved project oversight, leading to better compliance with project timelines and budgets. The study supports the relevance of mobile technology in modern construction project management. However, while it successfully introduced mobile-based tracking and communication, it did not incorporate a full ERP framework that integrates financial management, resource planning, and decision-support tools. The present study aims to address this limitation by developing a web-based ERP system with mobile accessibility and data-driven decision support.

According to Serrano and Jocson (2024), the implementation of a mobile reporting application at the Department of Public Works and Highways (DPWH) significantly improved field reporting processes. The study focused on enhancing data accuracy and reducing reporting delays by introducing a mobile application that allowed field engineers to submit reports in real-time. While the application improved operational efficiency, some usability challenges were observed, particularly in areas with poor network connectivity and data entry limitations on small screens. The findings of this study highlight the potential of

mobile applications in streamlining construction-related reporting processes. However, the study focused solely on field reporting without integrating broader project management functionalities such as resource allocation and financial tracking. The present study expands upon this by incorporating decision-support tools and ERP functionalities to provide a more holistic solution for construction project management.

According to Ramos and Villanueva (2021), Enterprise Resource Planning (ERP) systems have played a crucial role in streamlining construction project workflows in Luzon-based firms. Their study examined the benefits of ERP adoption in budget tracking, procurement, and labor management. The results indicated that firms utilizing ERP solutions experienced a 30% increase in operational efficiency due to centralized data management and automated reporting. This study supports the development of the DUV Construction ERP Integrated Management System with Mobile App, as it aims to integrate similar ERP-driven solutions to enhance project oversight, ensure real-time data synchronization, and improve cost efficiency in construction operations.

Foreign Studies

According to Boutros et al. (2024) conducted a study on the diffusion of Enterprise Resource Planning (ERP) systems in the construction industry, particularly in developing countries. The study examined the implementation of ERP modules and their impact on project monitoring, resource management, financial control, and decision-making processes. The findings emphasized that ERP integration enhances operational efficiency by streamlining workflows, optimizing resource allocation, and reducing project delays. Additionally, the research identified challenges such as financial constraints, resistance to change, and the necessity for customized ERP solutions tailored to construction firms' specific requirements.

According to Mandičák et al. (2022) in their study "Design of Economic Sustainability Supported by Enterprise Resource Planning Systems in Architecture, Engineering, and Construction" examined the global implementation of ERP systems in the AEC industry to improve economic sustainability and project efficiency. The study emphasized how ERP systems assist companies in resource planning, cost control, and decision-making, which are crucial for complex construction projects. The findings revealed that ERP systems significantly improve financial monitoring, scheduling, and real-time data analysis, ultimately enhancing operational efficiency. Additionally, the study highlighted the adoption of advanced modules such as predictive analytics and IoT integration to optimize project management.

According to Minhas and Potdar (2020) conducted a bibliometric analysis on the application of Decision Support Systems (DSS) in the construction industry, identifying how DSS improves decision-making, project efficiency, and risk management. Their study highlighted that globally, DSS integration helps mitigate challenges such as project delays, cost overruns, and safety concerns by providing data-driven insights. The research emphasized that systematic and bibliometric approaches enhance decision-making methodologies, allowing for better project monitoring and resource planning.

According to Galjanić et al. (2022), their study "Decision Support Systems for Managing Construction Projects: A Scientific Evolution Analysis" explores the development and application of Decision Support Systems (DSS) in construction project management. The research provides a comprehensive analysis of DSS evolution, highlighting how these systems contribute to improved decision-making, risk management, and resource optimization in construction projects. The study identifies key trends in DSS adoption, including the integration of artificial intelligence, big data analytics, and predictive modeling to enhance project efficiency. Additionally, it emphasizes the importance of DSS in mitigating project uncertainties, reducing delays, and ensuring cost-effective decision-making.

According to Junussova et al.(2022), their study examined the integration of Resource Planning Systems (RPS) into Building Information Modeling (BIM) to support sustainable construction practices. The research emphasized that incorporating RPS within BIM enhances resource efficiency, improves project planning, and supports sustainable

decision-making in construction projects. By aligning construction resources with project requirements, the system optimizes resource utilization, reduces waste, and ensures cost-effectiveness, all of which are critical to achieving sustainability in the construction industry. The study also identified the challenges of implementing such systems, including data interoperability and the need for skilled personnel to operate these advanced systems effectively

Synthesis

The reviewed literature and studies reveal a consistent emphasis on the role of Enterprise Resource Planning (ERP) systems in improving operational efficiency, data centralization, and overall productivity across various industries. Both local and international sources highlight the integration of ERP with mobile technologies and decision support systems as a growing trend, particularly in sectors that require real-time monitoring and resource management, such as construction.

Findings show that existing ERP solutions are often developed for large-scale enterprises and lack customization for small to medium-sized construction firms. Many systems do not address specific on-site and off-site coordination needs, and mobile functionality is either limited or absent. Furthermore, several studies point to the absence of localized ERP tools that incorporate decision-making support features, which are essential in managing complex construction workflows and ensuring timely project execution.

These gaps indicate a clear need for a system that combines web-based ERP functionality with mobile access and built-in decision support features, tailored specifically for construction-related operations. The convergence of these components has not been extensively explored in previous works, especially within the context of local construction firms.

In summary, the literature supports the development of a system that addresses the unmet needs in the construction industry, particularly in terms of accessibility, real-time data use, and informed decision-making. This highlights the relevance and necessity of ERP solutions that are both industry-specific and technologically adaptive.

Chapter 3

TECHNICAL BACKGROUND

Organizational Chart

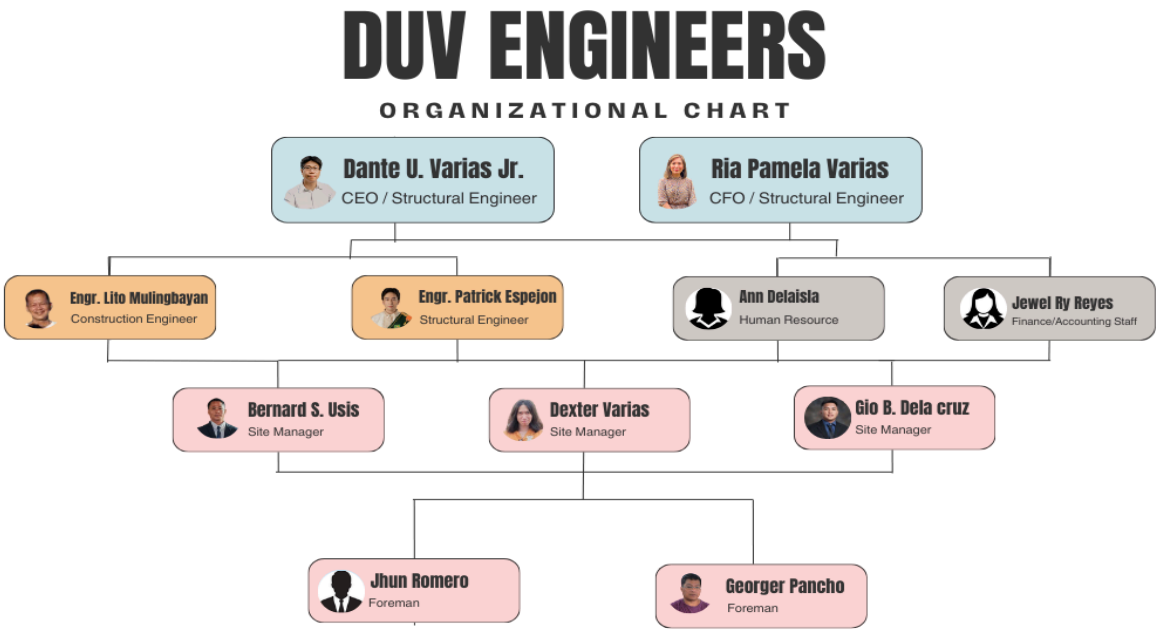

***Figure 1**. Organizational Chart of DUV Engineers.*

This figure presents the organizational structure of DUV Engineers, providing a clear view of how roles and responsibilities are distributed within the company from top management down to field operations.

System Flowchart

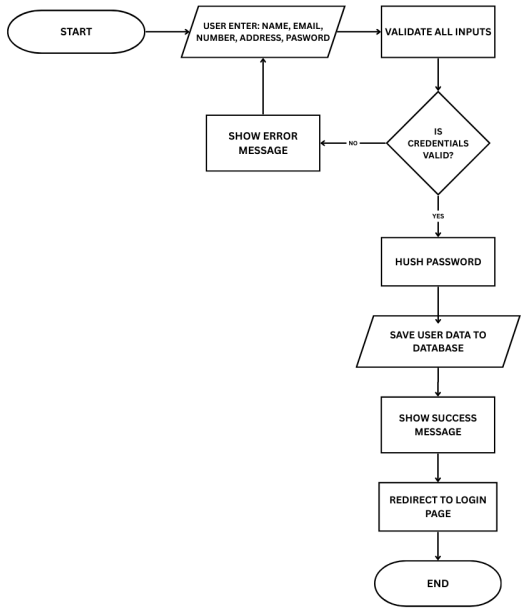

Figure 2. *Client Register Flowchart*

Figure 2 shows how the system handles Client login and authentication. The process starts when a user enters their username and password. The system first checks if the inputs are complete and properly formatted. If there's an issue, an error message prompts the user to try again. If the inputs are valid, the system checks the credentials against its database. Invalid credentials lead to another error message and a prompt to re-enter the details. If the credentials are correct, the user is successfully logged in and redirected to their dashboard, completing the login process.

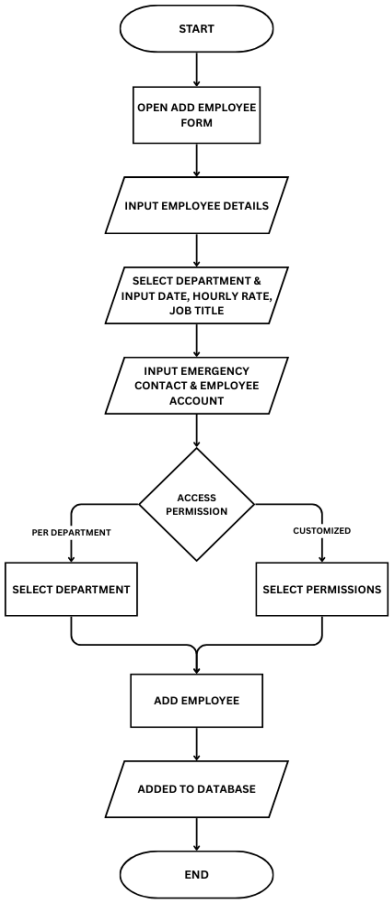

Figure 3. *Add Employee Flowchart*

Figure 3 shows the process of adding a new employee into the system. It begins with opening the add employee form, followed by inputting the employee's personal details. The user then selects the department and enters additional information such as the hiring date, hourly rate, and job title. Next, emergency contact details and the employee's account credentials are provided. The system then requires access permissions to be defined, either by department or through customized settings. Once all data is entered and permissions are set, the employee is added and the information is saved to the database, completing the process.

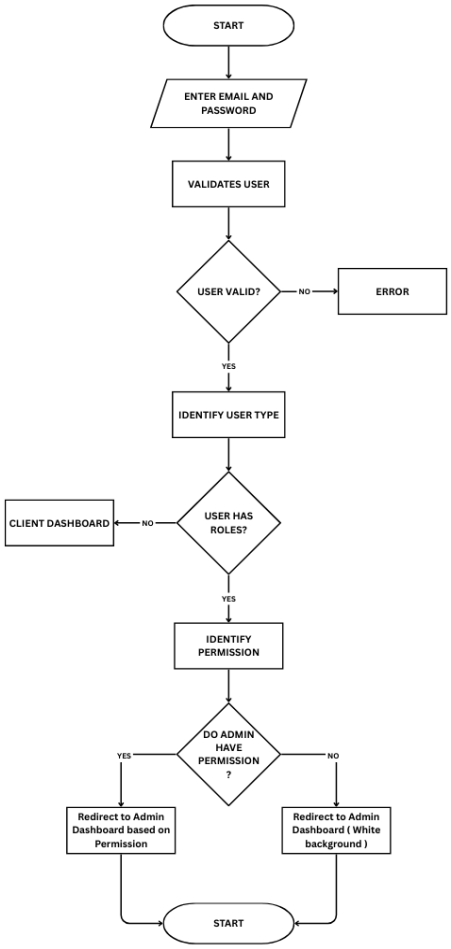

Figure 4. *Login Flowchart*

Figure 4 shows the login process flowchart. The user enters their email and password, and the system validates the credentials. If invalid, an error is displayed. If valid, the system identifies the user type. Clients are directed to the client dashboard, while users with roles proceed to check their permissions. Admin users with permissions are redirected to the dashboard based on permission, while those without permission are redirected to the admin dashboard. The process ends once the appropriate dashboard is shown.

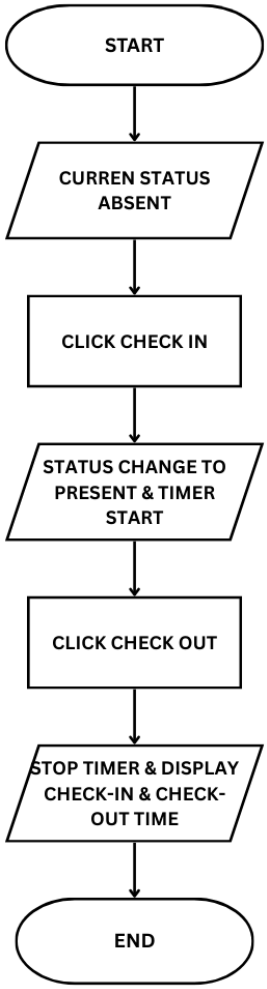

Figure 5. *Attendance Monitoring Flowchart*

Figure 5 shows the attendance monitoring process. It begins with clicking the check in status then the employee working hour will begin, it will display the timer and status changed to present. After clicking check out, the timer stops and it will display check in and check out time and recorded to database.

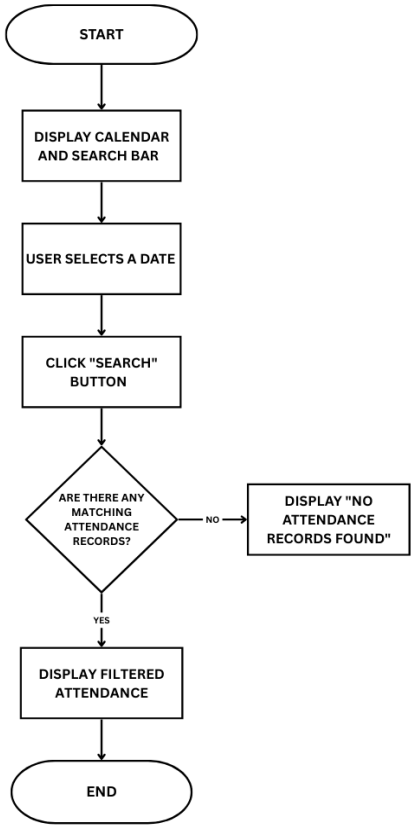

Figure 6. *Attendance Searching Flowchart*

Figure 6 shows how a user can search for attendance records by selecting a specific date. The process starts when a calendar and search bar are displayed on the screen. The user picks a date they're interested in and clicks the "Search" button. The system then checks to see if there are any attendance records for that particular date. If records are found, they're shown to the user. If not, the system displays a message saying "No attendance records found." Once that message or the filtered data is shown, the process comes to an end.

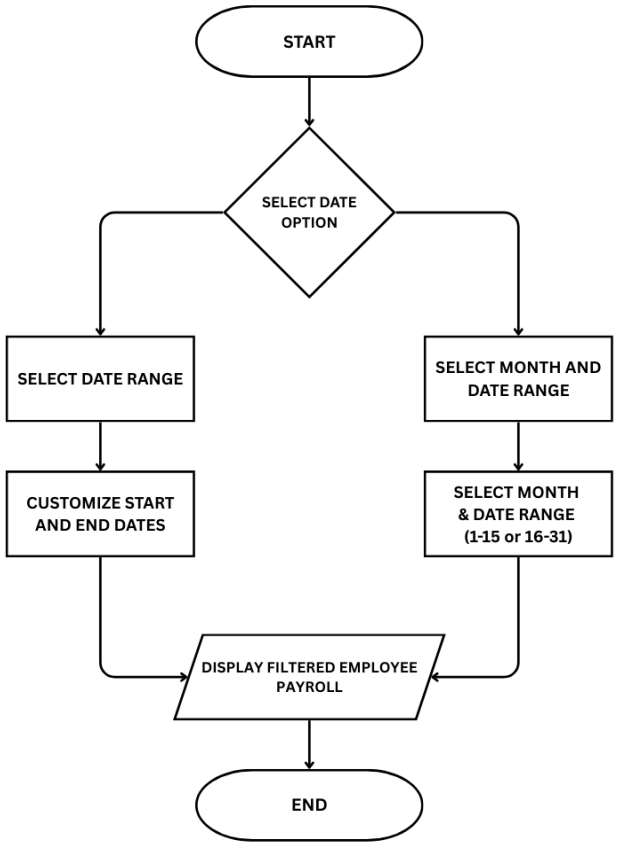

Figure 7. *Payroll Period Flowchart*

Figure 7 shows how a user can filter payroll records by selecting a specific date range or month. The process begins when the user is presented with the choice to select either "select date range" or "select month and date range". If the user selects "select date range," they can customize the start and end dates using a calendar. Alternatively, if "select month and date range" is chosen, the user selects a month and a fixed date range (1-15 or 16-31). After the selection, the system filters and displays the payroll records that match the chosen criteria. The process concludes with the filtered payroll data being shown to the user.

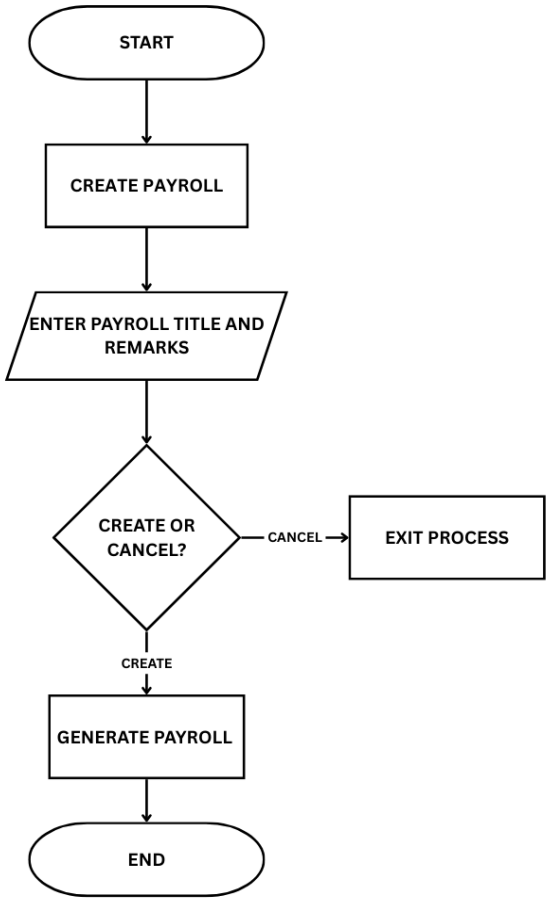

Figure 8. *Generate Payroll Flowchart*

Figure 8 shows the process of generating a payroll. The flow begins when the user initiates the payroll creation process by entering the payroll title and remarks. The system then asks whether the user wants to proceed with creating the payroll or cancel the operation. If the user chooses "Create," the payroll is generated. If "Cancel" is selected, the process ends, and no payroll is generated. This flow ensures that payrolls are only created when the user is ready and has reviewed the necessary details.

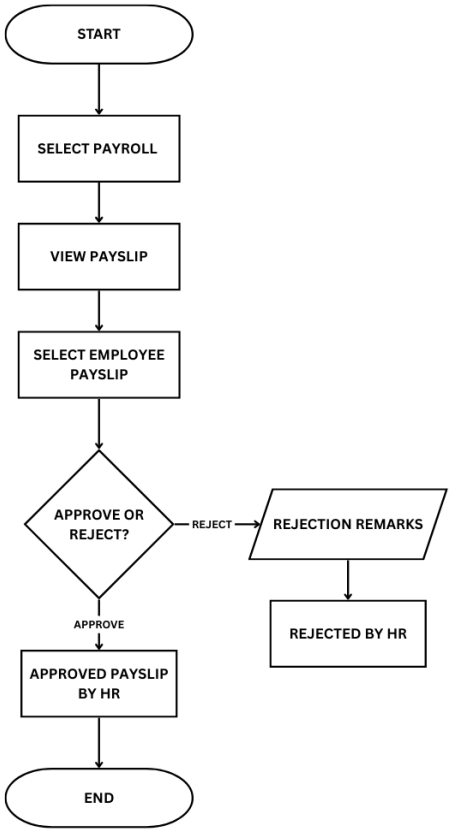

Figure 9. *HR Create Payslip Flowchart*

Figure 9 shows the hr create payslip process. The HR selects a payroll and then an individual employee's payslip. The hr can view the payslip details to validate the payslip. HR is prompted to either approve or reject the payslip. If approved, the payslip is marked as approved while if rejected, HR provides rejection remarks, and the payslip is marked as rejected and input rejection remarks. This process ensures that HR has the final say on employee payroll processing and can provide necessary feedback for rejected payslips.

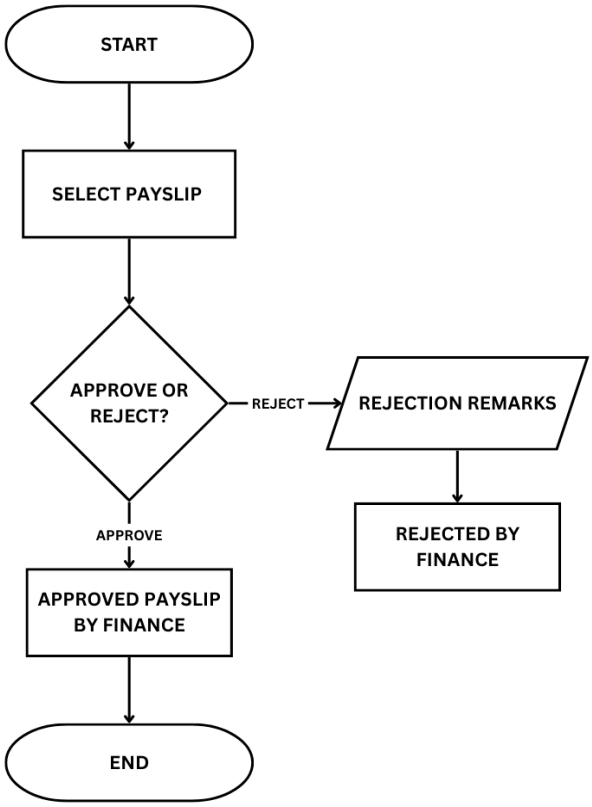

Figure 10. *Finance Payslip Approval Flowchart*

Figure 10 shows the process of approving or rejecting a payslip in the finance department. The flow begins when the user selects a payslip to review by hr, and they approve or reject it. If they approve the payslip, it is marked as "Approved by Finance." If the payslip is rejected, the user must provide rejection remarks, and it is marked as "Rejected by Finance." This ensures that each payslip is either processed for payment or sent back for corrections, depending on the review outcome.

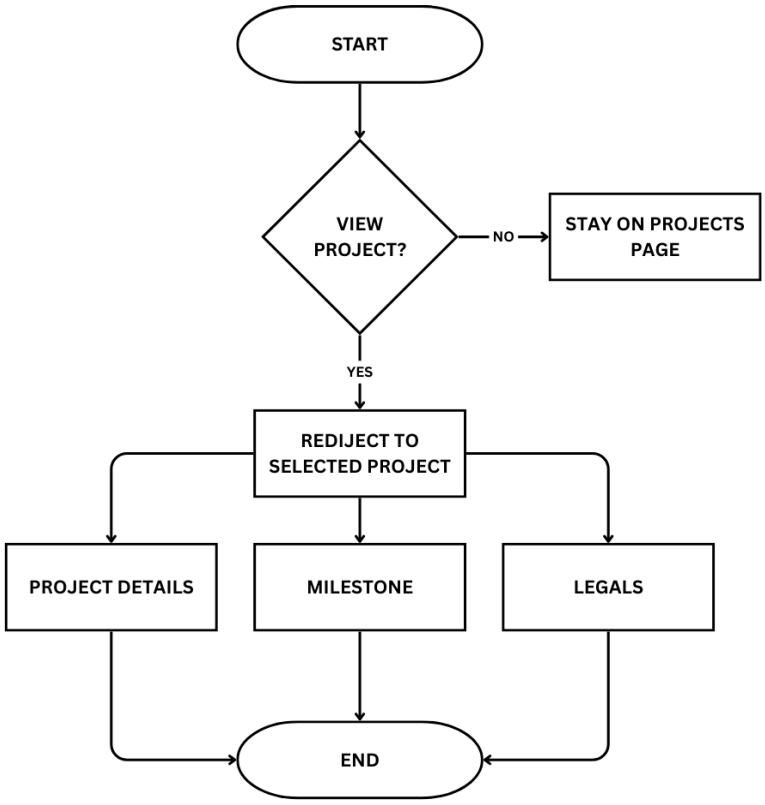

Figure 11. *Engineers Project Flowchart*

Figure 11 shows the flowchart details the process of viewing a specific project in the engineer's section. It starts with the user on the projects page, where they are given the option to view a selected project. If they opt to view the project, they are redirected to the project's detailed page, which includes sections for project details, milestones, and legal documentation. If the user chooses not to view the project, they remain on the projects page. This flow allows for easy navigation and access to relevant project information.

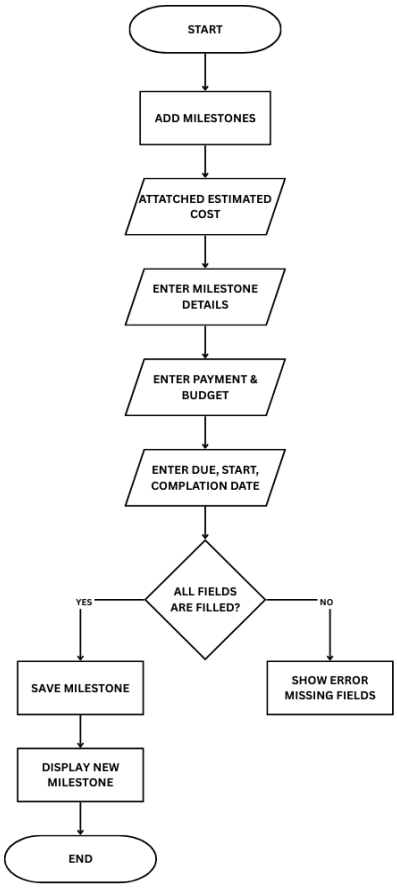

Figure 12. *Add Milestones Flowchart*

Figure 12 shows the process of adding a milestone to a project. The process begins when the user selects the “Add Milestone” option. The user is prompted to attach an estimated cost PDF file and enter the milestone title and details. Next, they input the payment amount, budget amount, start date, due date, and completion date. A decision step checks if all required fields are filled. If any field is missing, an error message is shown. If all inputs are complete, the user clicks the "Save" button. The system then adds the milestone to the project’s milestone list, completing the process.

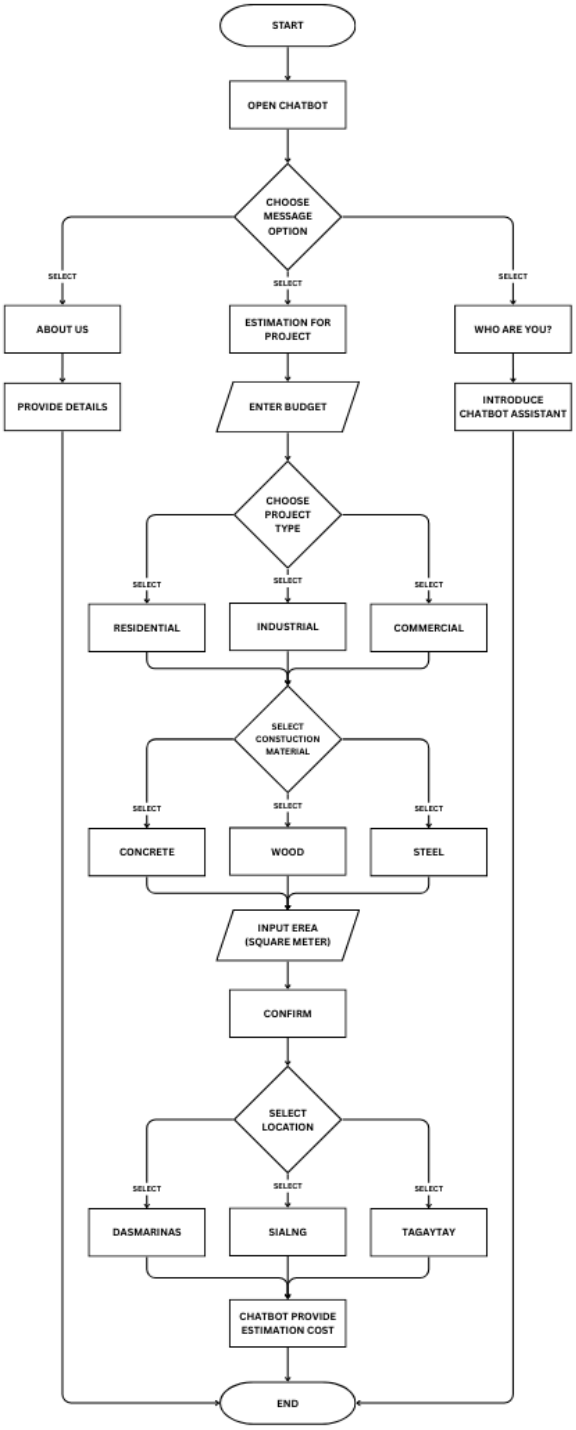

Figure 13. *Chatbot Flowchart*

Figure 13 shows the process of interacting with a chatbot. The flow begins when the user opens the chatbot, which then presents them with three options: "About Us," "Estimation for a Project," or "Who are you?". If the user selects "About Us," the bot will provide information about DUV. If "Who are you?" is chosen, the bot introduces itself as a chatbot assistant. On selecting "Estimation for a Project," the chatbot will prompt the user to input their budget, confirm the amount, and then choose the type of project they are estimating, such as residential, industrial, or commercial. The user is also asked to select a construction material (concrete, wood, or steel) and input the size in square meters. After confirming the project size, the user selects a location from options such as Taytay, Dasmarinas, Tagaytay, and Silang. The chatbot then calculates and provides an estimated cost for the project. If the estimated cost exceeds the user's budget, the chatbot will notify them that the cost exceeds their budget.

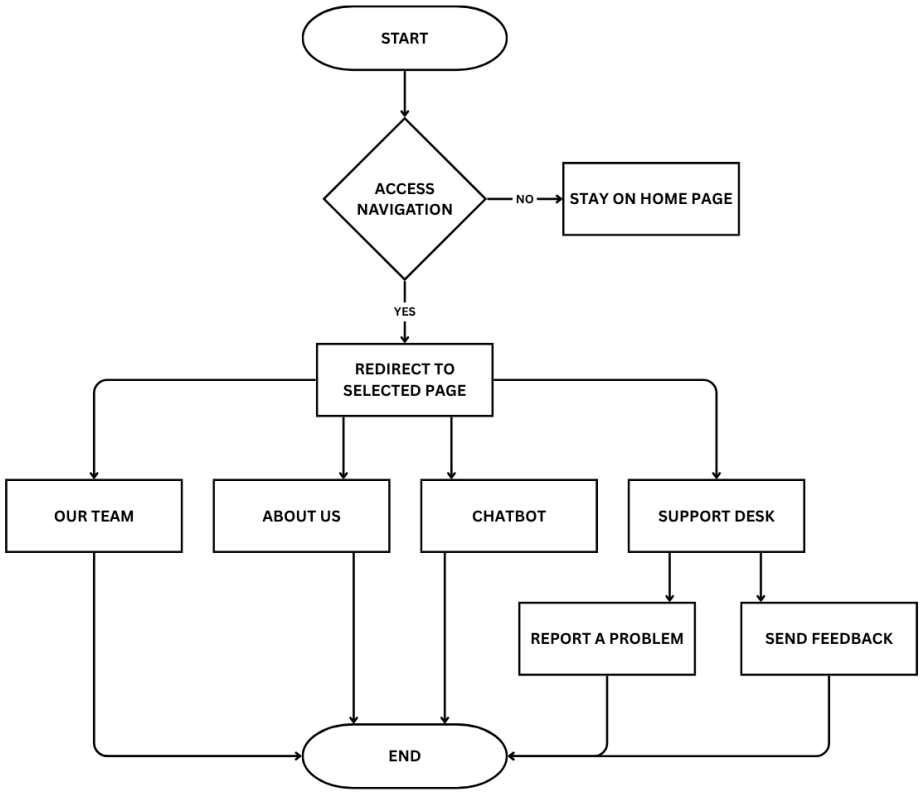

Figure 14. *Client Web Page Flowchart*

Figure 14 shows the flowchart for accessing a client web page. The process begins with the user deciding whether to access the navigation. they are redirected to the selected page, which includes options like Our Team, About Us, Chatbot, and Support Desk. From the Support Desk section, the user can further select between Report a Problem or Send Feedback. The flow ends after selecting one of these options, ensuring users can navigate to the appropriate section for their needs.

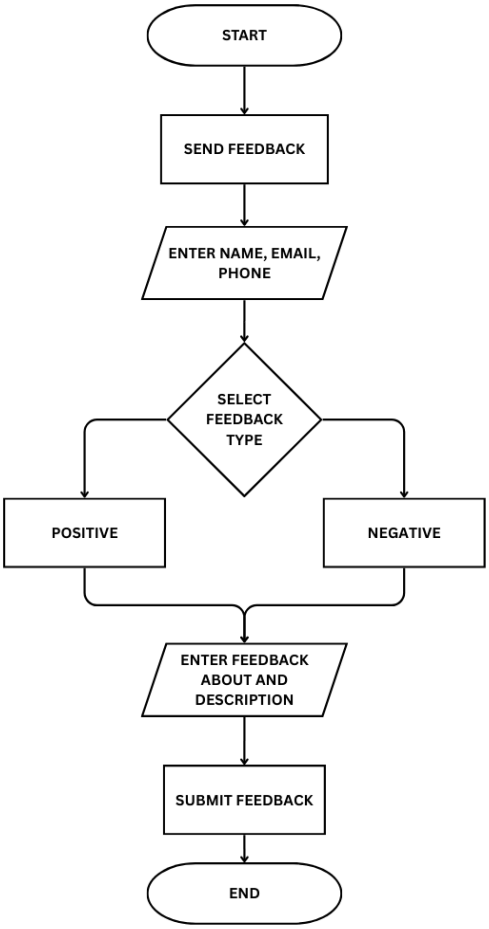

Figure 15. *FeedBack Flowchart*

Figure 15 shows the flowchart for feedback. The process begins with the user entering account details. Then, the client selects the type of feedback—either positive or negative. After selecting the feedback type, the user proceeds to input the subject of the feedback and its description. Once submitted, the process ends.

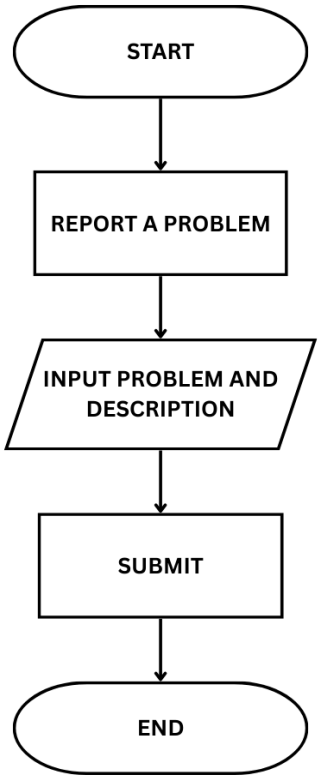

Figure 16. *Problem Reports Flowchart*

Figure 16 shows the process of reporting a problem in the system. The process starts when a user chooses to report an issue. They are then required to input the details of the problem along with a description. After providing the necessary information, the user submits the report. Once submitted, the process ends, and the issue is recorded for further review or action.

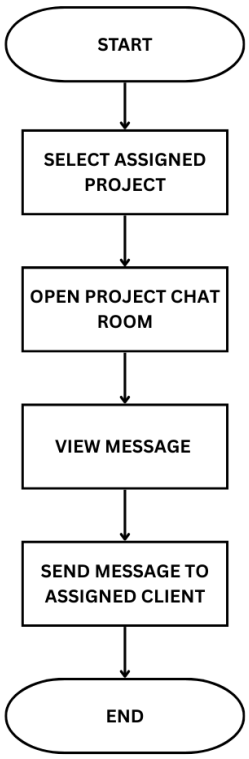

Figure 17. *Project Chat Flowchart*

Figure 17 shows the chat process within a project-based system. User selects or views the assigned project, which automatically links the client to their corresponding engineer in a one-on-one chatroom. Inside the chat interface, both the client and engineer can view past messages, type new messages, and send them in real time. The system ensures that only the assigned pair can communicate within that project space, maintaining a clear and private communication channel throughout the duration of the project.

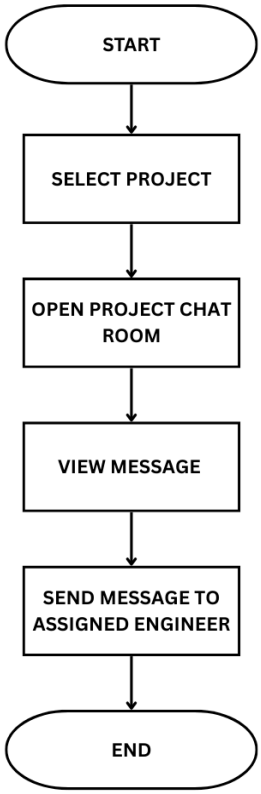

Figure 18. *Project Client Chat Flowchart*

Figure 18 shows the chat process within a project-based system. Client selects or views the project, which automatically links the client to their corresponding engineer in a one-on-one chatroom. Inside the chat interface, both the client and engineer can view past messages, type new messages, and send them in real time. The system ensures that only the assigned pair can communicate within that project space, maintaining a clear and private communication channel throughout the duration of the project.

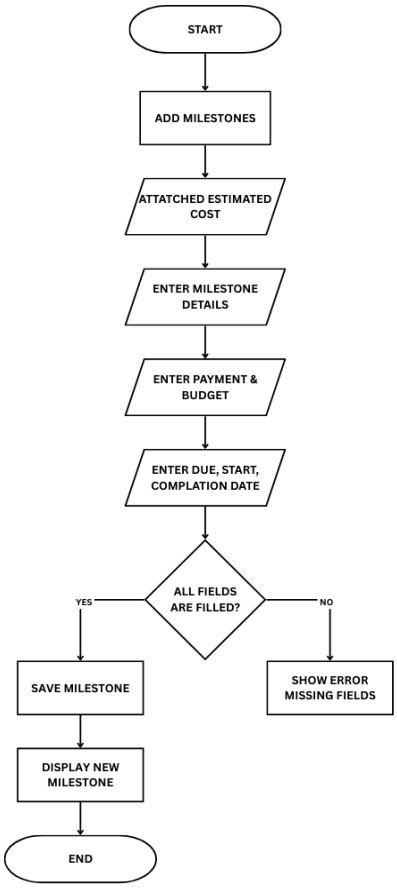

Figure 19. *Requesting Budget Flowchart*

Figure 19 shows the simplified flow of requesting a project budget. After adding a new milestone, the user can click the "Request Budget" button, then proceed to add project expenses by entering the necessary details. Once saved, the entry will automatically appear in the expense tracking section.

Data Flow Diagram

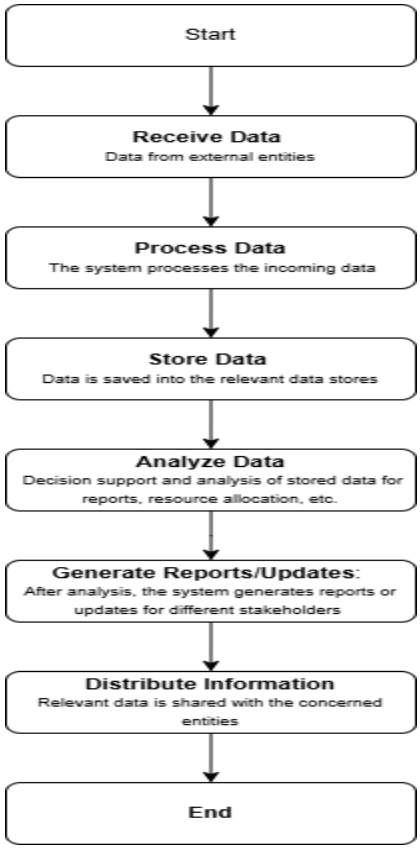

Figure 20. *Blocked diagram*

Figure 20 shows a blocked diagram representing a data processing system. The process starts by receiving data from external entities. The system then processes the data to prepare it for further action. After processing, the data is stored in relevant data stores for future use. Once stored, the system proceeds to analyze the data, which supports decision-making, report generation, resource allocation, and other analyses. Based on this analysis, the system generates reports or updates for different stakeholders. Finally, the system distributes the information, sharing relevant data with the concerned entities, and the process ends.

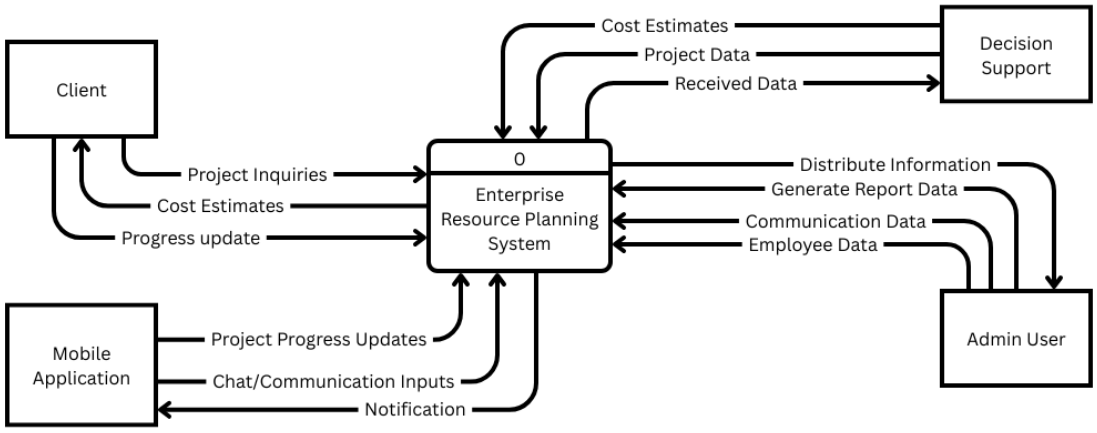

Figure 21. *Context Diagram*

Figure 21 shows a Context Diagram, or Level 0 Data Flow Diagram (DFD), illustrating the high-level interactions between the Enterprise Resource Planning (ERP) System and external entities. The ERP system is the core processing unit, receiving and distributing data to various stakeholders. Clients submit project inquiries and receive cost estimates and progress updates. The Decision Support component receives project data and cost estimates while providing data for strategic analysis. Admin Users input employee and communication data and receive reports and distributed information. The Mobile Application sends project updates and chat inputs to the ERP, which returns notifications. The diagram clearly outlines data flows and the functional boundaries of the ERP system.

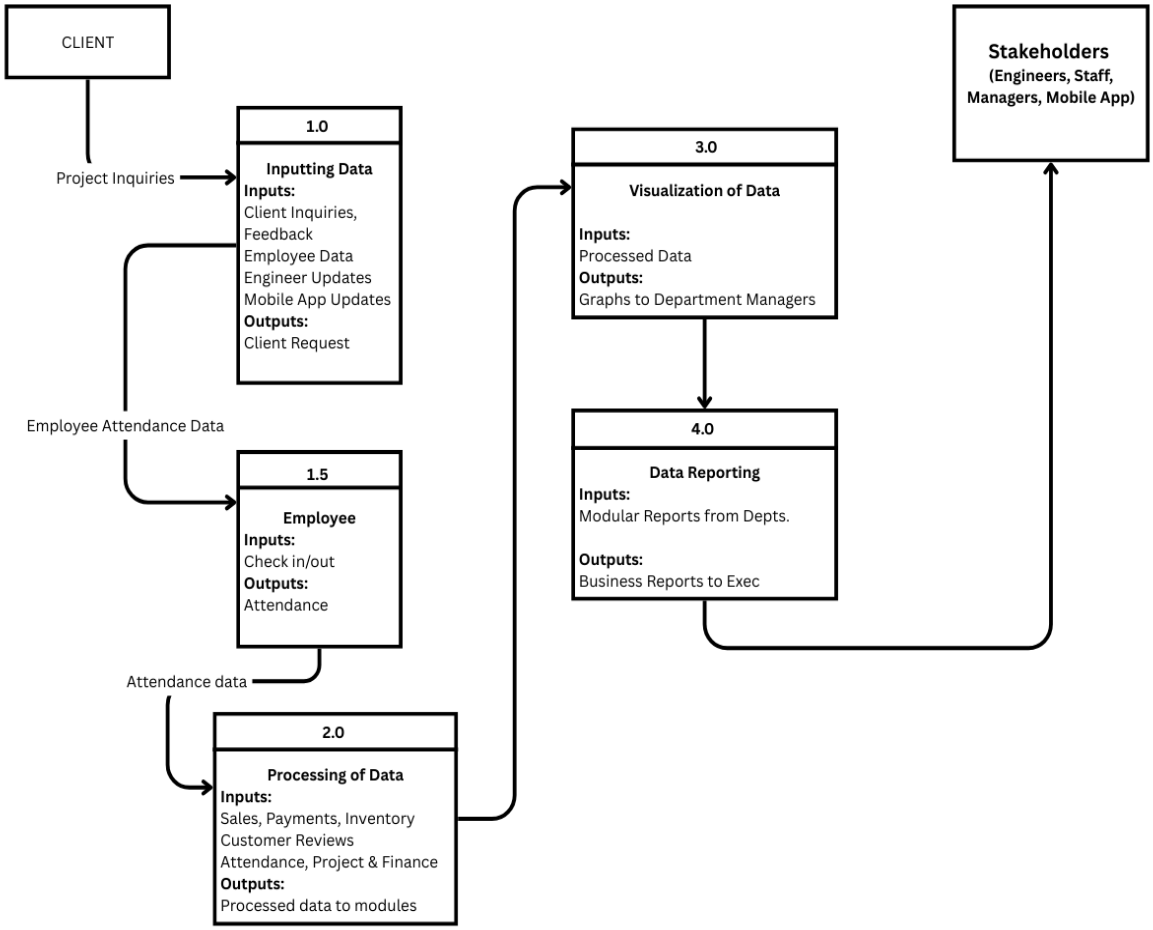

Figure 22. *First Level Data Flow Diagram*

Figure 22 shows a First Level Data Flow Diagram (DFD) that breaks down the internal processes of the Enterprise Resource Planning (ERP) system into detailed functional components. The diagram begins with the client submitting project inquiries and employee attendance data, handled by the Inputting Data (1.0) and Employee (1.5)

processes. Inputting Data receives client inquiries, feedback, employee data, engineer updates, and mobile app updates, and outputs client requests. The Employee module captures check-in/check-out data and outputs attendance. This data flows into the Processing of Data (2.0) module, which also processes sales, payments, inventory, customer reviews, and project and finance data to produce outputs for other modules. These processed data are used in the Visualization of Data (3.0) module to generate graphs for department managers. The final process, Data Reporting (4.0), compiles business reports for executives from departmental reports. All outputs support stakeholders such as engineers, staff, managers, and mobile app users, highlighting the ERP system's role in streamlined data management and decision-making.

System Architecture

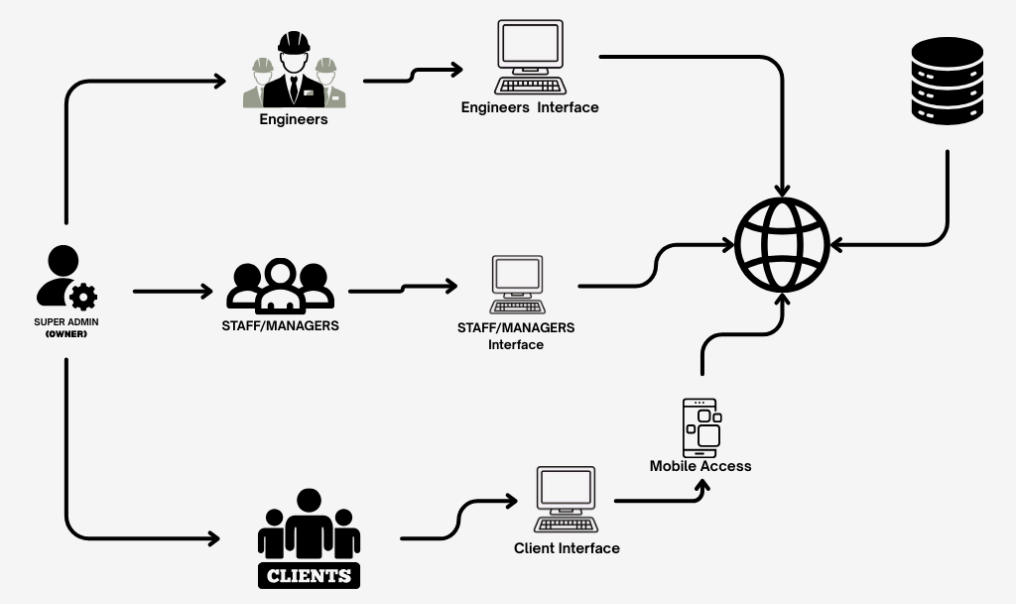

Figure 23. *System Architecture*

Figure 23 shows the data flow diagram (DFD) of the proposed system, which illustrates the flow of information between various system components. The diagram begins with the Super Admin (Owner), who interacts with Staff/Managers via the Staff/Managers Interface. These staff members then have access to the system's central database, which is connected to the Engineers through the Engineers Interface. The system allows the Staff/Managers to interact with Clients through the Client Interface and also provides Mobile Access for clients to interact with the system remotely. All interactions are facilitated through a centralized web connection that ensures the smooth exchange of data across different system modules. This flow ensures efficient management, from the Super Admin overseeing the system to the engineers, staff, and clients, with real-time data updates managed via the central database.

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