

UNIVERSITI TEKNOLOGI MARA

**THE DEVELOPMENT OF WORKFORCE
MANAGEMENT SYSTEM FOR FALCON
KINGDOM ACADEMY USING RULE-BASED
SYSTEM**

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**BACHELOR OF INFORMATION SYSTEMS (Hons.)
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**The Development of Workforce Management
System for Falcon Kingdom Academy Using
Rule-Based System**

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SUPERVISOR APPROVAL

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The project was prepared under the supervision of the project supervisor, Miss Nurul Nadzirah binti Mohd Hasri. It was submitted to the Faculty of Computer and Mathematical Science and was accepted in partial fulfillment of the requirements for the degree of Bachelor of Information System Engineering.

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STUDENT DECLARATION

I certify that this project to which it refers is the product of my own work and that any idea or quotation from the work of other people, published or otherwise, are fully acknowledged in accordance with the standard referring practices of the discipline.



.....
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ABSTRACT

Falcon Kingdom Academy, a prominent event consultancy managing a workforce of approximately 190 facilitators, currently relies on decentralized manual processes utilizing WhatsApp and spreadsheets for workforce coordination. This traditional approach has led to critical operational inefficiencies, including subjective and inaccurate facilitator assignments, difficulty in tracking attendance and performance, and persistent delays in salary disbursement. To address these challenges, this project presents the development of a Workforce Management System (WFM) integrated with a Rule-Based System to optimize the staffing process. The system development follows the Modified Waterfall Model, ensuring a structured progression from requirement elicitation to deployment. During the initial planning, preliminary interviews were conducted to identify the problem of the current method of assigning facilitators. This requirement phase involved interview sessions with the stakeholders involved as operation manager and facilitator. The result of the requirement phase has constructed the problem, scope, and defined the functional requirement. The analysis has brought production rules in designing the rule-based system by implementing Forward Chaining Strategy. The core innovation of the system is the implementation of an Inference Engine.. This engine automates decision-making by processing facilitator profiles against a distinct Knowledge Base of safety and competency rules. The resulting use case description and use case diagram has brought onto the design phase to design the system architecture, user interface design and the database design. In the development phase of the web application, by utilizing the Laravel PHP Framework and MySQL, the stakeholders are empowered with distinct operational capabilities. Key features include a centralized dashboard for Operation Managers to define event requirements, validate attendance logs, and leverage the expert system to generate conflict-free staffing recommendations. Simultaneously, a self-service portal enables Facilitators to manage their availability, formally accept or decline job offers, and view their historical performance ratings. Future works for the system envision the development of a native mobile application to enhance accessibility for staff in remote field locations and the integration of predictive analytics to forecast workforce shortages during peak operational seasons.

TABLE OF CONTENTS

CONTENT	PAGE
SUPERVISOR APPROVAL	ii
STUDENT DECLARATION	iii
ACKNOWLEDGEMENT	iv
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	ix
LIST OF TABLES	xi
LIST OF ABBREVIATIONS	xii

CHAPTER ONE : INTRODUCTION

1.1 Background of Study	1
1.2 Problem Statement	3
1.3 Project Objectives	6
1.4 Project Scope	7
1.5 Research Significance	8
1.6 Summary	

CHAPTER TWO : LITERATURE REVIEW

2.1 Workforce	10
2.1.1 Workforce Trends In Malaysia	10
2.2 Workforce management	11
2.3 Artificial Intelligence in Decision Support and Management	13
2.4 The Expert System (ES): Architecture and Modern Relevance	17
2.5 Rule-Based Expert Systems (RBES)	17
2.5.1 The Knowledge Base	18
2.5.2 The Inference Engine	18
2.6 Design and Architecture of Rule-Based Expert Systems for Personnel Assignment	18
2.6.1 System Architecture Model	18

2.4 Similar existing system	21
2.4.1 Zendesk	22
2.4.2 iTrent	22
2.4.2 Data-driven smart manufacturing (DDSM)	23
2.4.3 Similar system comparison	23
2.6 System Development Life Cycle (SDLC)	25
2.6.1 System Development Life Cycle Models Comparison	25
2.6.2 Waterfall Model Approach	27
2.7 Summary	29

CHAPTER THREE: METHODOLOGY

3.0 Executive Summary	31
3.1 Preliminary Study	35
3.1.1 Preliminary Interview with Stakeholder	35
3.1.2 Project Problem Identification	35
3.1.3 Literature Review on Project Title	36
3.1.4 Choosing System Development Life Cycle Model	36
3.1.5 Project Proposal Preparation	34
3.2 Requirements	35
3.2.1 Requirements Gathering	35
3.2.2 Analyze Requirements	35
3.2.3 Requirements Documentation	35
3.3 Design	36
3.3.1 Design rule-based expert system logic	36
3.3.2 Process Flowchart	36
3.4 Implementation	38
3.4.1 Development of Rule-Based Inference Engine	38
3.5 Project Timeline	40
3.6 Summary	40

CHAPTER FOUR: ANALYSIS AND FINDINGS

4.1 Requirement Gathering & Analysis	42
4.1.1 Results of Demographic Interview Session	42
4.1.2 Requirement Elicitation and Analysis	44
4.1.3 Mapping Interview Results with Rule-Based Logic	47
4.1.4 The Business Rules and Constraints	50
4.1.4 Documents Gathered From Falcon Kingdom Academy	52

4.1.5 Result from Requirement Analysis	57
4.1.6 Requirement Modelling	61
4.1.7 Use Case Description	63
4.1.8 Domain Class Diagram	69
4.2 The Design of Workforce Management System	71
4.2.1 Design Class Diagram	71
4.2.2 User Interface Design	72
4.2.3 Database Design	86
4.2.4 Rule-Based Logic Design	88
4.3 The Development of Workforce Management System	89
4.3.1 The Development of Workforce Management System Features	90

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion	94
5.2 Limitation	95
5.3 Future Work	96

REFERENCES 97

APPENDICES

APPENDIX A : EXPERT SYSTEM ARCHITECTURE & FLOWCHART	103
APPENDIX B : Interview Session	104
APPENDIX C : Interview Session with Mr. Shafiq	106
APPENDIX D : INTERVIEW TRANSCRIPT WITH MR.QAWIEM	107
APPENDIX E: INTERVIEW TRANSCRIPT WITH MR.SHAFIQ	109
APPENDIX F: SOFTWARE REQUIREMENT SPECIFICATIONS	112

LIST OF FIGURES

FIGURE	PAGE
1.0 Activity Diagram of Current Process of Managing Workforce in Falcon Kingdom Academy	3
1.1 Assigning process issue	4
1.2 Attendance validation issue	5
1.3 Salary payment form	6
2.1 Basic Expert System Architecture	17
2.2 Architecture of the Expert System	19
2.3 Flowchart Forward Chaining	20
2.4 Zendesk Interface	21
2.5 Waterfall Model Approach	26
3.0 Modified Waterfall Model	29
3.1 Flowchart of Rule-Based System for Facilitator Filtering	37
3.2 Gantt Chart of Project Timeline	40
4.1 Use Case Diagram of Workforce Management System	63
4.2 Domain Class Diagram of Workforce Management System using Rule-Based System Logic	69
4.3 Detailed Design Class Diagram	71
4.4 Relational Table for Workforce Management System	86
4.5 Data Dictionary for Facilitators	87
4.6 Data Dictionary for Events	87
4.7 Data Dictionary for Event Rules	87
4.8 Pseudocode of Rule-Based Logic Design	89
4.9 Implementation Code of Manage Event	91
4.10 Implementation Code of Update Profile	92
4.11 Implementation Code of Rule-Based Expert System	93

LIST OF TABLES

TABLE	PAGE
2.1 Rule-Based Expert System vs Alternative	14
2.2 Table of similar system comparison	22
2.3 Table of methodology comparison	25
3.1 Modified Waterfall Model System Development Lifecycle	31
4.1 Business Process & Operational Workflow Analysis and Requirements	43
4.2 Requirement Extraction and Analysis from Interview Session	44
4.3 Rule-Based Logic Interview Results	47
4.4 Interview Questions and Answers about the business rules and constraints	50
4.5 Documents List	52
4.6 List of use cases derived from interview content analysis	57
4.7 List of domain,attributes and business rules derived from interview content analysis	58
4.8 Category Specific Competency Rules	60
4.9 Category Specific Experience Rules	61
4.10 General Availability Rules	61
4.11 List of Use Case with corresponding use cases	61
4.12 Use Case Description List	63
4.13 Use Case Description Assign Facilitator	64
4.14 Use Case Description Recommend Suitable Facilitators	66
4.15 Use Case Description Submit Feedback Form	67
4.16 List of User Interface Designs	72
4.17 Decision Matrix for Facilitator Recommendation	88

LIST OF ABBREVIATIONS

WFM	Workforce Management
PHP	Hypertext Preprocessor
TVET	Technical, Vocational , Education and Training
AGM	Annual Grand Meeting
RBES	Rule-Based Expert System
HR	Human Resource
AI	Artificial Intelligence
ML	Machine Learning
HRM	Human Resource Management
KB	Knowledge Base
IE	Inference Engine
DB	Database
HCM	Human Capital Management
SDLC	System Development Life Cycle
RAD	Rapid Application Development
SRS	Software Requirement Specification
DDSM	Data-Driven Smart Manufacturing
CSS	Cascading Style Sheet
HTML	Hypertext Markup Language
UI	User Interface
UX	User Experience
MVC	Model-View-Controller

CHAPTER 1

INTRODUCTION

This chapter presents the background of study, problem statement, project objectives, project scope, and project significance.

1.1 Background of Study

According to Vance & Paik (2015), workforce refers to an organization's global human talent, wherever the employees are temporarily or permanently located in the world. In short terms, workforce meaning the pool of labor available for work or not, whether it is full-time or part-time workers.

A well-trained and adaptable workforce is crucial for driving economic growth and meeting industry demands, a fact that has been recognized by policymakers worldwide. According to Ramasamy and Rowley (2013), Malaysia's labor policies started emphasizing technical, vocational education and training (TVET) to support rapid industrial growth and increase the employability of the local workforce. In the 1990s, a shift toward privatization, skills upgrading, and the early foundation of a knowledge-based economy.

Workforce management is about helping organizations run smoothly by making sure the right people are in the right place at the right time. It involves things like scheduling, tracking attendance, and managing performance. By keeping everything organized in one place, it is easier to stay compliant with labor laws, make informed decisions, and create a more efficient and supportive work environment (Khan, 2024). The goal is to boost productivity while minimizing potential risks. According to Ramasamy and Rowley in 2013, they said that the importance of aligning skill formation with economic transformation, especially as Malaysia

transitions to a service-driven and innovation-led economy. This necessitates systems that can effectively match labor supply with demand, enhance productivity, and support continuous skill development.

Falcon Kingdom Academy, a training and event consultancy under an organization named MH Kingdom Empire, serves in making team building and development programs. It was founded by Mohd Hafiz bin Mohd Nor who is the current executive director. The headquarters of this organization is located at Taman Melawati, Kuala Lumpur. The business that Falcon Kingdom Academy specializes in training and motivational events such as team building, workshops, camps, educational trips and family programs. This wide range of types of events is handled by using team-based and mostly hands-on experience. The current workforce is approximately around 190 workers including permanent workers, part-time and full-time facilitators. As there is a wide variety of programs that are being held, a group of facilitators are needed to facilitate the operations of operating the event. The assigning facilitator process is currently based on the experience, education, ability and behavior. However, the performance of their facilitators is hardly noticeable by the facilitator manager as there are too many facilitators to be managed. The experience felt by each facilitator may vary based on bias and perspective. This gives a different thoughts on recommending facilitators to events due to the perception of each facilitator is vary. Thus, with incorrect assignment of facilitators in event, problems such as inexperienced facilitators, bad behavior and lack of cooperation happens.

This organization serves as a relevant example of such operational challenges as it faces difficulties in assigning the correct facilitator for each type of event. With a workforce management system, the operation department can manage their facilitators better.

1.2 Problem Statement

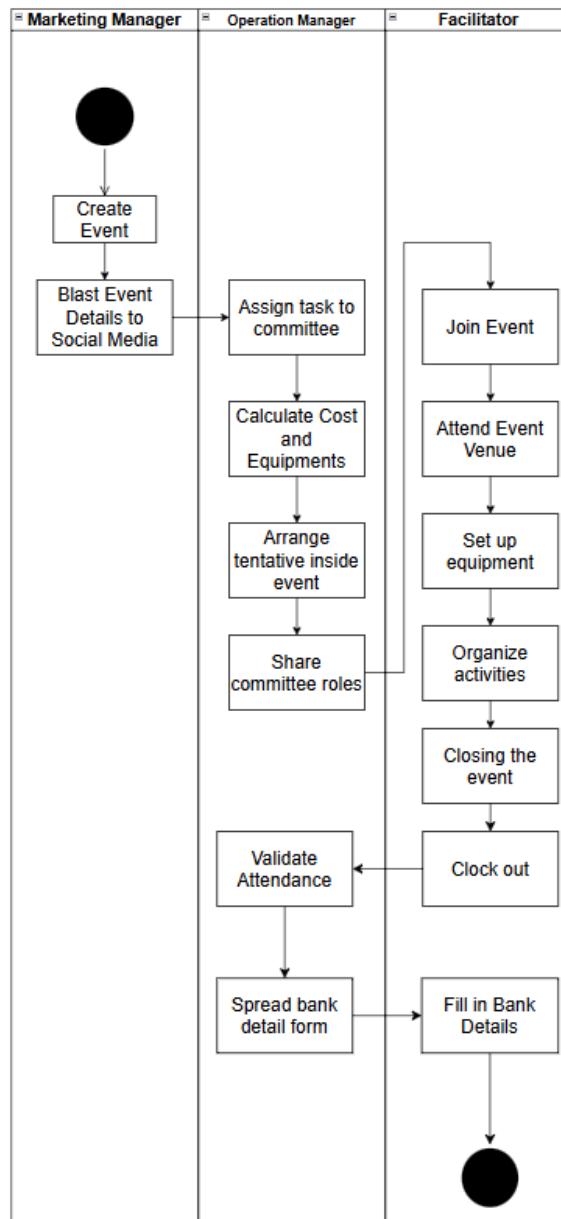


Figure 1.0 : Activity Diagram of Current Process of Managing Workforce in Falcon Kingdom Academy

Figure 1.0 shows the current process of managing the workforce inside the company. This activity diagram is the current event workflow process that occurs within Falcon Kingdom Academy, with three major roles involved, Marketing Manager, Operation Manager and

Facilitator. The process initiates with the Marketing Manager, who is responsible for creating the event and advertising the details on social media sites to attract customers. After the creation of the event, the Operation Manager takes over and assigns tasks to the committee members and calculates the costs and equipment needed for the event. The manager then arranges the event's tentative schedule and distributes specific roles among the facilitator committee before the execution of the event.

During the event, facilitators perform their role: join the event, attend the venue, set up equipment, organize activities and help the program run smoothly. Once the event is over, facilitators clock out and fill in their bank details via a form to get paid. Meanwhile, the Operation Manager confirms if the facilitators really attended the event and that payment details are collected and prepared for the processing of payment.

Overall, the diagram represents the end-to-end process flow in event management, from planning and execution to attendance validation to salary processing. However, it also puts in focus the weaknesses of the prevailing manual process for effective tracking of attendance and management of remunerations that could be greatly simplified with an integrated system for smooth coordination and automation.

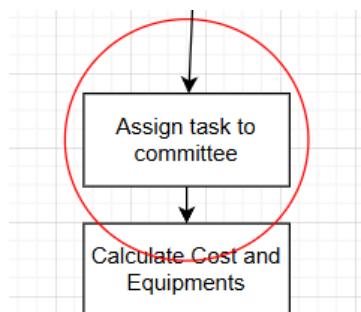


Figure 1.1: Assigning process issue

Based on an interview conducted on 27 May 2025 with Mr. Qawiem, operational manager for Falcon Kingdom Academy. Figure 1.1 shows that the main problem that is faced is the frequent wrongly assigned roles for facilitators. The operation department struggles to determine whether the facilitator is suitable for a particular event. Since Falcon Kingdom Academy offers multiple types of events, it is important to understand the performance and behavior of each facilitator before assigning tasks. Currently there is no system that suggests facilitators. The assigning process relies heavily on assumptions and cooperation experience.

This problem leads to inefficiency in managing the workforce during daily operations. Often resulting in human skills frequently being overlooked and unnoticed as there is no approach in evaluating human skills (Bibi et. al., 2021). To solve this problem, a workforce management system is issued to help suggest facilitators that are most suitable for specific event roles.

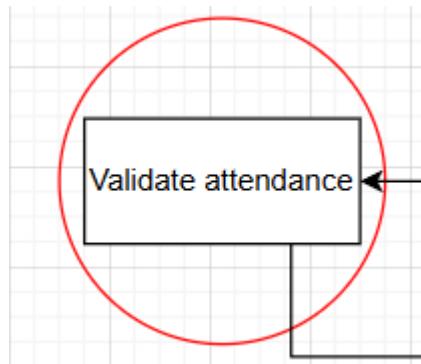


Figure 1.2 : Attendance validation issue

Based on Figure 1.2, the current process of the facilitator in attending and clocking out from their work is by sharing live location using Whatsapp. This method of validating attendance does not use any application programming interface that integrates with another system for storing attendance. This brought to problems such as difficulty in tracing attendance and performance of facilitators.

Furthermore, the operations manager also finds it difficult to track the performance of facilitators after each event. Without clear records, it's hard to evaluate how well each facilitator has performed or to make informed decisions when assigning them to future event slots based on their attendance, strengths and weaknesses. Having this data stored would make it much easier not only to manage assignments more fairly but also to recognize and reward facilitators during events like the Annual Grand Meeting (AGM) or on the day of the program itself.

Next, the current process of paying the facilitator their own salary for each event participation is becoming increasingly difficult due to increment of facilitator. Mr. Qawiem discussed that the process of filling in the form using Whatsapp tends to affect the salary payment causing salary payment delay issues for workers after an event. Workers tend to receive their salaries late due to oversight, as there are many programs and people involved at the same time. Payment tracking relies on WhatsApp groups, and a WhatsApp form is used to collect

bank details. The current process of collecting bank details results in redundant information and inconsistency due to repeated manual process entries.

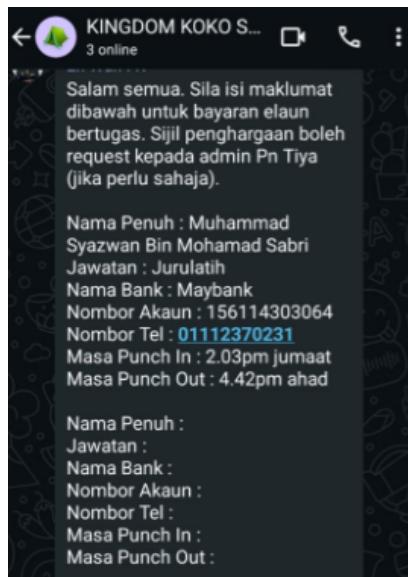


Figure 1.3 : Salary payment form

Figure 1.3 shows one of the forms that facilitators need to fill in after completing the event. The difficulty of tracking bank details increases when the collection of bank details increases. This inefficient work process is time consuming due to manually tracking bank details from forms filled in WhatsApp. According to Badroldin et al. (2018), late payments are a critical issue, often resulting from poor financial management and documentation errors. Such delays can disrupt cash flow and affect timely salary disbursements.

1.3 Project Objectives

The objectives of this project are:

1. To identify the requirements for the workforce management system for Falcon Kingdom Academy using rule-based system.
2. To design the workforce management system for Falcon Kingdom Academy using rule-based system.
3. To develop the workforce management system for Falcon Kingdom Academy using rule-based system.

1.4 Project Scope

The scope of this project aims to develop a Workforce Management System specifically for Falcon Kingdom Academy, focusing on improving the workforce management of full-time and part-time facilitators. The system will be tailored for the department involved specifically for the operation department that manages the workforce of facilitators. Besides, it will also be used by facilitators for collecting their performance and attendance. The development of this system will be deployed as a web based application.

The system will feature a Rule-Based Expert System (RBES) as a decision support mechanism. As defined by Molina et al. (2022), a rule-based expert system improves decision-making by simulating human reasoning through a Knowledge Base composed of 'IF-THEN' rules and an Inference Engine that applies these rules to known facts. In this project, the system will not rely on simple keyword matching; instead, it will utilize the inference engine to strictly validate facilitator profiles against a set of logical constraints, such as mandatory safety certifications, minimum tenure years, and performance thresholds. By automating the assignment process through these explicit decision rules, the system ensures that every recommendation is logically justified, thereby reducing subjective bias and enhancing operational efficiency.

Other than that, facilitator performance tracking feature aims to store all of the facilitators performance and behavior. The collection data of performance and behavior will be mainly based on forms filled in by facilitators that operate the events and the attendance of each event. The performance and behavior will be rated based on their experiences working collaboratively. As the attendance will be strictly based on their time attending the event.

Additionally, the system will incorporate a facilitator payroll feature, addressing current issues such as delayed payments. Delayed payments due to manual processing in tracking the bank details in text forms inside WhatsApp, will be replaced by a more friendly feature that stores all of the bank information of each facilitator. The payroll feature will also track the facilitator involvement of events that are created.

The main users of this system will be the operations department, responsible for scheduling and workforce allocation, ensuring the system supports daily operational needs effectively including facilitators as a model to collect data for their behavior and performance to

produce a recommendation.

1.5 Research Significance

The development of this Workforce Management System is highly significant to improve the daily operations and overall effectiveness of Falcon Kingdom Academy as the organization continues to handle a growing number of programs and facilitators. The current manual processes used for scheduling, attendance tracking, and payments have become increasingly inefficient and lead to error. This system offers a practical solution by helping the operations department manage the workforce more smoothly and with greater accuracy.

The proposed Workforce Management System is designed to make this process easier and better. By using past data and performance records, the system will suggest facilitators who are best suited for specific roles. The operation department will receive this benefit by ensuring that assignments are fair and well-matched, and that each program runs more smoothly with the right people in place.

Another key benefit is better performance tracking. At the moment, there are no records to keep track of how well facilitators perform in their roles. Without that information, it is hard for the operation department to make informed decisions for future assignments, or to recognize facilitators for their contributions. Plus, facilitators will also get assigned to more suited events suitable for their capabilities.

Finally, the system also helps address payment delays. Currently, salaries are processed manually through WhatsApp forms, which can be disorganized and lead to late payments. By tracking attendance and collecting bank details within the system, payments can be managed more efficiently and on time, building more trust and satisfaction among the facilitators.

1.6 Summary

Chapter 1 covers the outline and foundation of the Workforce Management System for Falcon Kingdom Academy to solve key operational problems such as assigning facilitators, tracking performance, and salary payments. The current processes for assigning facilitators, tracking performance, and managing salary payments are manual and fragmented. These manual processes lead to problems such as wrongly assigned facilitators, unknown facilitator

performance, and unreliable salary payments. These problems lead to inefficiency in organizing staff, and event flow. By combining all these functions into one management system will be an effective way in managing the workforce.

CHAPTER 2

LITERATURE REVIEW

This chapter will present a review of existing relevant literature on the development of the workforce management system.

2.1 Workforce

The workforce plays a crucial role in achieving business goals in any industry. According to Vance & Paik (2015), workforce refers to an organization's global human talent, wherever the employees are temporarily or permanently located in the world. Meanwhile, Hadrawi et al. (2022) emphasizes that workforce involves group of individuals engaged or available for work, either in a country or region or in a specific company or sector. The workforce encompasses all individuals engaged in productive activities within an organization or economy, regardless of employment type, and represents a critical human capital asset essential for operational efficiency and strategic growth. According to Khang et al.(2023), there are multiple types of workers inside an organization such as freelancers, part-time, full-time, consultants, independent contractors, freelancers, temporary workers and seasonal workers.

This project was focused on managing the workforce of full-time and part-time facilitators as there are approximately a number of 190 facilitators inside Falcon Kingdom Academy.

2.1.1 Workforce Trends In Malaysia

The rising gig economy inside Malaysia changed the workforce trend in Malaysia since the COVID-19 pandemic. The change of the workforce trends is driven by demographic and shifting economic policies. According to Nawawi et al. (2023) , the authors emphasize that economic activity related to people's short-term, project-based, and outcome-defined labor is referred to as the gig economy. As the gig economy, specifically in e-hailing companies like GrabFood, Foodpanda, and GrabCar, the workforce tends to rise in these companies as the flexibility of time management

(Nawawi et al. , 2023). According to Zelma (2024) policymakers now face the task of regulating this sector to protect worker welfare. Academically, researchers observe that gig work lacks the stability of traditional jobs, tasks are ad hoc and contract-based, with weak ties to a single employer (Zelma , 2024).

The changes impact the workflow of organizations shifting from working traditionally to remotely distributed workforces resulting in increase of online solution usage. Mkhize & Lourens (2025) emphasize that incorporating artificial intelligence (AI), robotics, and machine learning is foreseen to herald the automation of knowledge-based jobs and tasks. New technologies and automation tools reconstruct the workforce transforming AI and digital solutions leading to hybrid collaboration between machines and humans. Leading to new job roles and skills for technology adaptations.

These transformations show the changes of the workforce going on through major shifts from traditional workflows into digitalized and remote works. Flexible gig jobs and remote work inside corporations has become a new norm in this era.

2.2 Workforce management

A workforce management is a solution that helps organizations in automating and optimizing processes related to employee time tracking, labor deployment, self-service for both employees and managers, and ensuring workplace safety. It is all about strategically planning and coordinating the people behind the operation. It involves making sure the right employees with the right skills are in the right place at the right time (Onifade et al. , 2025). According to Adesanyan et al. (2025), the workforce management focuses on aligning staffing levels with workloads by making sure the right people are assigned to the right jobs at the right time. This involves planning which staff are really suited for the work and creating a work schedule to match with their own capabilities. The services industry is one of the industries especially in event planning that highly depends on human coordination.

2.2.1 Elements of workforce management

To extinguish a better understanding of the impact of a workforce management, it is important to explore the elements of a workforce management. In developing workforce management, these processes create bonds together to create a comprehensive system that manages daily operations and

also supports the organization in improving the current state of their performance.

A. Workforce planning

According to Wang (2024), workforce planning is a process that helps businesses prepare for future staffing needs based on their goals, growth plans, and changes in the market. Rather than reacting to staffing issues as they arise, workforce planning allows organizations to stay one step ahead. The crucial part of this process is forecasting. This means using current employment trends, company plans, and industry conditions to predict how many staff will be needed in the future. Tools like statistical models and scenario planning help HR teams explore different possibilities, such as what to do if the business expands rapidly or if there's an unexpected downturn (Wang, 2024). This kind of preparation helps organizations stay prepared and ready to adapt.

However, in recruiting people in the process of workforce planning, the traits , performance, and capabilities need to be considered before assigning them to roles. Hiring the right people is not just about filling job positions, it is about finding individuals with the right skills and mindset who can contribute to organizational growth. When recruitment focuses on both talent and shared values, it helps build a team that not only meets today's needs but also supports where the organization wants to go in the future (Wang,2024). In the context of service-based companies like Falcon Kingdom Academy, allocating the right facilitators in each of their events is crucial for the comfort of the participants and the workflow efficiency during the execution of the event. This impacts in giving a more contribution to their own growth and also the cooperation between facilitators that work together in organizing the events.

B. Scheduling

Scheduling plays a crucial role in workforce management, as it directly impacts both operational efficiency and employee health. Effective scheduling ensures that the right number of staff with the appropriate skills are available at the right time to meet service demands. Rinaldi et al. (2022) highlight the importance of incorporating ergonomic risk factors and human performance into scheduling decisions, noting that worker capabilities

vary across different tasks and even across task sequences.

C. Time and attendance management

Time management is all about planning your time wisely and staying in control of how it's spent on different tasks, so you can be more effective, efficient, and productive. Especially in the event industry, managing time well is absolutely essential for determining whether an event runs smoothly or falls apart (Ahmad et al. , 2012). Time management plays a critical role in determining job performance, especially in environments like event planning that involves a variety of types of facilitators for handling the events. This time and attendance management helps in supporting the decision for choosing the experienced facilitators and acknowledge facilitators that are new.

D. Analytics and reporting

Analytics and reporting help make workforce planning smarter. By using data, organizations can make better decisions about their people. Organizations can improve hiring, spot potential issues early, and make sure the workforce is growing in the right direction to support long-term goals. Elugbaju et al. (2024) said that Human Resource Analytics (HRA) provides evidence-based insights that support effective workforce planning and succession management, utilizing both quantitative and qualitative data to ensure a holistic understanding of workforce dynamics. This way, with a proper analysis, it will improve the hiring process and retention.

This project was intended to implement the workforce elements into the system that involve workforce planning for assigning facilitators with suitable events, time and attendance management for tracking facilitator participation and also reporting for Falcon Kingdom Academy. This not only facilitated the workflow of managing their workforce, but also making beneficial impacts to the audience that attended the events.

2.3 Artificial Intelligence in Decision Support and Management

Artificial Intelligence has evolved from a theoretical discipline into a critical driver of operational efficiency across industries. In the context of Human Resource Management (HRM) and operations, AI is no longer limited to simple data processing but is increasingly tasked with complex decision-making, such as predicting workforce performance and optimizing resource allocation. Recent literature from ScienceDirect and IEEE Xplore indicates a paradigm shift where AI systems are designed not just to automate tasks but to augment human decision-making by handling high-dimensional constraints that exceed human cognitive capacity (Yang & Zhu, 2024).

In the specific domain of event management and staffing, the challenge lies in the "combinatorial explosion" of matching a finite pool of staff to dynamic event requirements while adhering to legal, physical, and preferential constraints. While modern machine learning (ML) models excel at pattern recognition, they often lack the transparency required for administrative decisions where justification is legally or operationally necessary. This necessity has sustained the relevance of symbolic AI, particularly Expert Systems, which offer interpretable and logical reasoning capabilities (Sarkar, 2021).

Table 2.1 : Rule-Based Expert System vs Alternative

Characteristic	Rule-Based Expert System (RBES)	Machine Learning (ML)	Mathematical Optimization (CP / MILP)	Evidence
Knowledge Representation	Explicit & Symbolic: Knowledge is encoded as human-readable "IF-THEN" rules and facts. It relies on a predefined knowledge base derived from domain experts.	Implicit & Sub-symbolic: Knowledge is distributed across weights and biases within a network. It is "learned" from large datasets rather than explicitly programmed.	Mathematical Formulation: Knowledge is represented as objective functions (e.g., minimize cost) and linear/non-linear constraints.	(Sarkar, 2021); (Yang & Zhu, 2024)

Reasoning Mechanism	Logical Inference: Uses inference engines (Forward/Backward Chaining) to logically deduce conclusions from facts. It mimics the step-by-step reasoning of a human expert.	Pattern Recognition: Uses algorithms (e.g., backpropagation) to identify statistical patterns and correlations in data to predict outcomes.	Search & Propagation: Uses solvers to explore the solution space (e.g., Branch and Bound) to find the mathematically optimal or feasible solution.	(Yang & Zhu, 2024); (Soto et al., 2013)
Explainability (Transparency)	High (White Box): The system can generate an execution trace explaining exactly why a decision was made. Essential for unions and legal compliance.	Low (Black Box): The decision-making process is often opaque and difficult to interpret without additional "Explainable AI" (XAI) layers.	Medium: Can prove optimality, but explaining <i>why</i> a specific schedule is the best among millions of options is abstract to non-technical users.	(Wang & Chen, 2024); (Sarkar, 2021)
Handling Constraints	Rigid: Excellent for enforcing binary regulations. Struggles with soft constraints (preferences) without complex fuzzy logic.	Probabilistic: Might "hallucinate" or violate hard constraints unless specifically constrained or penalized heavily during training.	Strict & Flexible: The gold standard for satisfying complex combinations of hard and soft constraints simultaneously.	(Soto et al., 2013); (Kaur et al., 2022)

Maintenance & Scalability	Difficult at Scale: Adding new rules can contradict existing ones, leading to a maintenance bottleneck. It does not "learn" from new data automatically.	Adaptive: Can retrain on new data to improve performance over time without manual code changes.	Scalable: Highly effective for large combinatorial problems (e.g., 500+ staff), but model formulation is complex.	(Yang & Zhu, 2024); (Li et al., 2025)
Primary Application in Staffing	Compliance & Validity: Ensuring assignments are legal, qualified, and safe (e.g., checking credentials).	Prediction & Profiling: Forecasting absenteeism, predicting demand, or profiling staff skills from unstructured resumes.	Optimization: Finding the single best roster that minimizes cost and maximizes fairness.	(Kaur et al., 2022); (Li et al., 2025)

The selection of a Rule-Based Expert System (RBES) over alternative artificial intelligence models (such as deep learning or pure mathematical optimization) is driven by the strict requirement for decision transparency and regulatory compliance in human resource allocation. Unlike neural networks, which operate as "black boxes," an RBES allows the system to generate an explicit execution trace, explaining precisely why a specific facilitator was assigned or rejected based on verifiable criteria like certification expiry or union constraints (Sarkar, 2021; Wang & Chen, 2024). This transparency is critical in event management to prevent perceptions of bias and to ensure adherence to safety ratios, such as the requirement for specific crowd management certifications, which must be treated as "hard constraints" that cannot be probabilistically violated (Yang & Zhu, 2024).

Furthermore, the assignment of a facilitator is rarely a binary decision but rather a qualitative assessment of "suitability." Recent research indicates that RBES architectures are uniquely capable of encoding these heuristics through Fuzzy Logic, allowing the system to mimic the nuanced judgment

of a human recruiter while maintaining the consistency of an automated system (Duodu & Hamidu, 2021). This capability not only improves the "fit" of the assignment but also supports long-term retention by systematically respecting facilitator preferences and skill-utilization goals, a factor identified as essential for workforce stability (Kaur et al., 2022).

2.4 The Expert System (ES): Architecture and Modern Relevance

Narrowing down from general AI, Expert Systems (ES) represent a knowledge-based approach designed to emulate the decision-making ability of a human expert. Unlike neural networks, which learn from data correlations, expert systems rely on explicit knowledge representation.

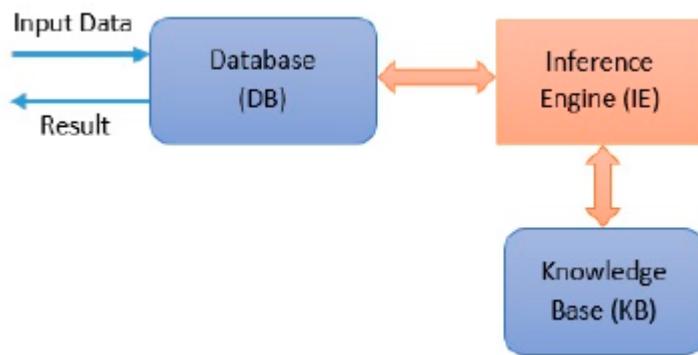


Figure 2.1 Basic Expert System Architecture (Hatzilygeroudis et. al, 2023)

Based on Figure 2.1, it illustrates basic expert system architecture. According to Hatzilygeroudis et. al (2023), the fundamental architecture of an expert system is composed of three distinct units that emulate human decision-making: the Knowledge Base (KB), the Database (DB), and the Inference Engine (IE). The Knowledge Base serves as the system's long-term memory, storing domain-specific expertise represented explicitly as "IF-THEN" production rules (Hatzilygeroudis et al., 2023).

The Expert systems remain vital in industrial applications, including fault diagnosis and decision analysis, because they decouple the domain knowledge from the reasoning mechanism (Yang & Zhu, 2024). This separation allows system architects to update staffing policies without rewriting the core processing code, a critical feature for event management where labor laws and venue safety codes frequently change.

The literature consistently identifies four core components that must be present in any robust ES:

1. Knowledge Base: The repository of facts and rules.
2. Inference Engine: The processor that applies rules to facts to derive conclusions.
3. Working Memory: A storage area for the current state of the specific problem (e.g., the current list of available staff).
4. Explanation Facility: A module that justifies why a specific decision was made (Yang & Zhu, 2024).

2.5 Rule-Based Expert Systems (RBES)

Within the family of expert systems, Rule-Based Expert Systems are the most applicable architecture for assignment problems where logic can be expressed as "IF-THEN" statements.

2.5.1 The Knowledge Base

Duodu and Hamidu (2021) demonstrate that in personnel selection, this knowledge is often fuzzy rather than binary. A rule might not simply state IF Experience > 5 Years, but rather use linguistic variables to approximate human reasoning, such as IF Experience is High AND Distance is Short THEN Suitability is Very High. This allows the system to rank candidates for an event rather than just filtering them, providing a nuanced "suitability score" that mimics a human recruiter's intuition (Duodu & Hamidu, 2021).

2.5.2 The Inference Engine

The engine acts as the "brain" of the assignment system. In the context of staffing, it must process two types of constraints defined in the literature:

Hard Constraints: Mandatory rules that cannot be violated, such as "Staff must possess a valid security license".

Soft Constraints: Preferences that should be optimized, such as "Prefer staff who live within 10km of the venue".

Kaur et al. (2022) emphasizes that effective assignment systems must prioritize these constraints to maximize retention and performance. Their work on volunteer task assignment illustrates that an inference engine must not only check for availability ("Is the person free?") but also optimize for "task-volunteer compatibility" to ensure long-term engagement (Kaur et al., 2022).

2.6 Design and Architecture of Rule-Based Expert Systems

Unlike statistical recommendation systems that rely on historical similarity patterns, a Rule-Based Expert System (RBES) relies on explicit logical deductions derived from human expertise. The literature defines the design of such systems through a modular architecture and specific decision flowcharts.

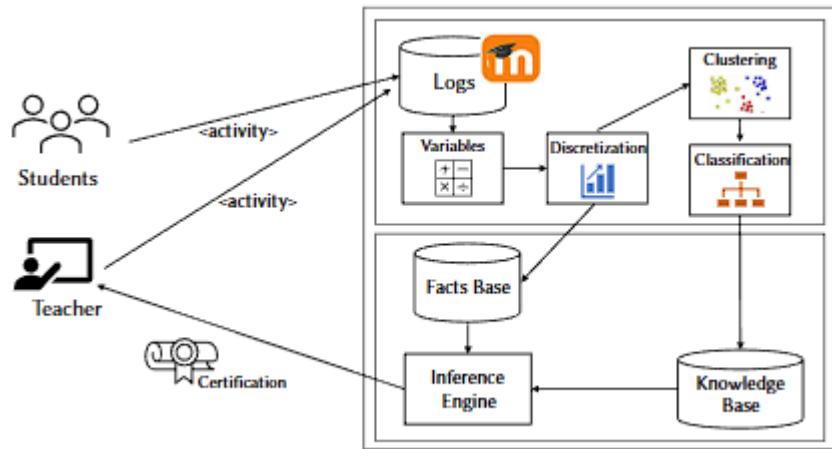


Figure 2.2 Architecture of the Expert System (Regueras & de Castro, 2022)

Based on the architecture diagram from Regueras et al. (2022), the system operates as a hybrid framework divided into two distinct phases. In the first phase, raw Logs regarding student and teacher activities are extracted from the Learning Management System and processed into meaningful quantitative Variables, which are then converted into categorical values through a Discretization process, which are subsequently analyzed by a Classification module to automatically generate the logical "IF-THEN" rules stored in the Knowledge Base. In the second phase, the system evaluates a specific teacher by processing their current course logs into a Facts Base, which the Inference Engine matches against the stored rules to deduce the teacher's usage profile, resulting in an automated Certification of their competence level (Regueras et. al, 2022).

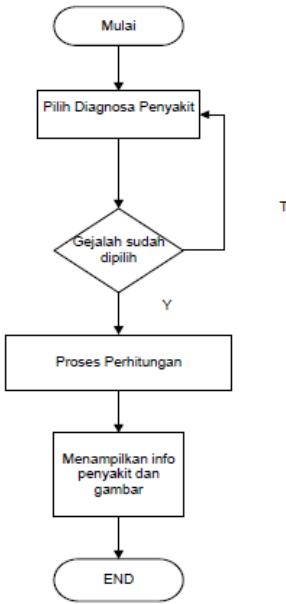


Figure 2.3 Flowchart Forward Chaining (Riyanto et. al, 2022)

Based on Figure 2.3 , forward chaining is a tracing process that begins by displaying a collection of convincing data or facts towards a final conclusion. Forward chaining starts from the premises or input information (if) first then leads to conclusions or derived information (then) or can be modeled as the following: IF (input information) THEN (conclusion) Input information can be in the form of data, evidence, findings, or symptoms. While conclusions can be in the form of goals, hypotheses, explanations or diagnoses. So that the direction of tracing forward starts from data to goals, from evidence to hypotheses, or from symptoms to diagnosis (Riyanto et al., 2022).

2.7 Similar existing system

In this technological era, the usage of workforce management in multiple industries has become a streamlined process that manages the operations. Another similar system that exists inside the market is Zendesk, iTrent and a data-driven smart manufacturing workforce management system.

2.7.1 Zendesk

Zendesk operates by managing daily customer support for a better engagement. It is a cloud-based system that helps in managing customer support, sales and communication. Moreover, Zendesk has tools such as Zendesk WFM AI that streamline the traditional workforce processes. Bouchrika (2025) made a review upon using this tool and stated that Zendesk Workforce Management is a tool

designed to optimize workforce planning and enhance operational efficiency.

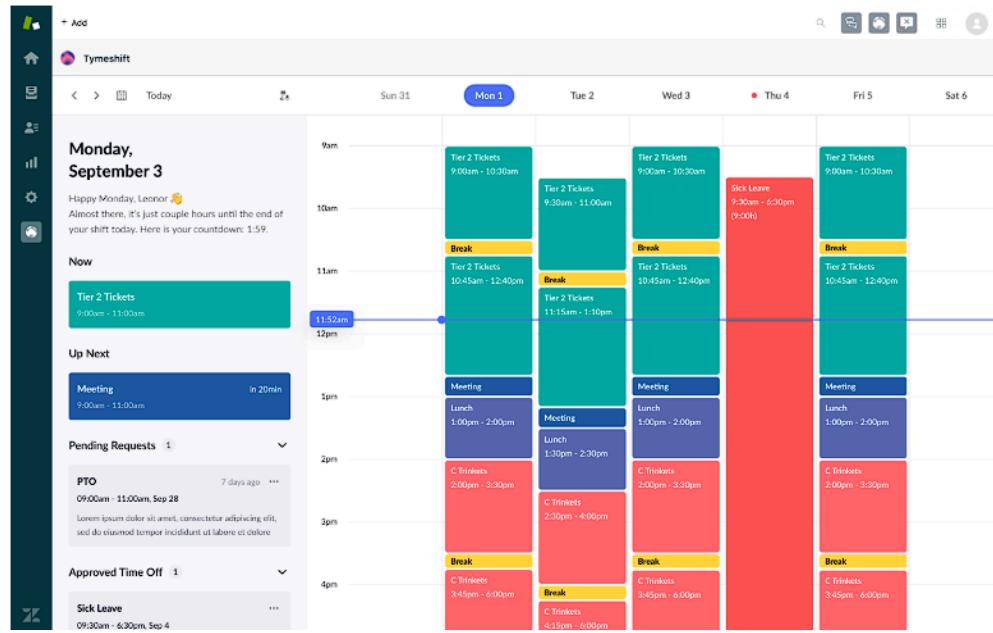


Figure 2.4 Zendesk Interface

It supports user, role and access management to ensure secure data handling. Meanwhile, real-time performance monitoring and customizable dashboards give access in tailoring the dashboards following the user preferences. The system offers shift scheduling capabilities as well as time and attendance tracking that has payroll system wage calculation. Forecasting tools help in planning staff allocation, while absence and leave management automate availability of staff. The cross-platform access empowers organizations to make informed, data-driven decisions and maintain agile, efficient, and satisfied support teams.

2.7.2 iTrent

Landa-Silva et al. (2010) present an integrated workforce management solution developed with Midland HR, targeting customer-service sectors with many part-time employees. Payroll, attendance, absence monitoring, and staffing forecasting are all integrated into iTrent's personnel scheduling system. Landa-Silva et al. (2010) also emphasize that the assignment of employees that matches customer demand, task assignment, and shift-pattern design are important components. Every employee has a skill profile, and each task or work unit assigns workers to positions that allow for flexible replacements and has the necessary skill positions into user-defined workforce pools.

Throughout the assignment, restrictions are enforced. The authors highlight that iTrent is flexible for managing part-time work and is well integrated with Human Resource (HR) processes, especially for scheduling. However, a limitation is that specific industry rules were not fully included and the early version of the system only supported a limited number of scheduling conditions

2.7.2 Data-driven smart manufacturing (DDSM)

Other than that, Pietroni & Marconi (2023) have developed a data-driven smart manufacturing workforce management system for a leather goods company. Pietroni & Marconi (2023) also emphasized a digitally integrated workforce management platform designed to improve efficiency, planning, and decision-making in a manufacturing environment. The system includes attendance management, one of the components of the workforce management system. The system traces the attendance and time of the workers inside the company. According to Pietroni & Marconi (2023), the application allows employees to make requests for permits and absence. The application also includes talent management that stores skills of the employees and matching the skills required for each task with the employee with the same capability. According to Pietroni & Marconi (2023), the application combines the best combination of employees' skills and skills required by the task to ensure the highest quality product possible. Lastly, the application also provides employees scheduling for the right task as it provides benefits in terms of work scheduling and staff planning optimisation (Pietroni & Marconi, 2023).

2.7.3 Similar system comparison

There are several similar systems to compare for seeing the advantages, similarities and differences could be adapted inside the project. Table 2.1 emphasizes Zendesk, BambooHR, and DDSM by evaluating their features, advantages, and disadvantages. DDSM, Zendesk and BambooHR provide comprehensive functionality, covering scheduling, attendance management, and performance reporting.

Table 2.2 Table of similar system comparison

Similar System	Scheduling	Attendance Management	Performance Report	Advantages	Disadvantages

Zendesk	✓	✓	✓	AI Driven and automated scheduling process.	Complex to learn
iTrent	✓	✓	✓	Fully integrated HR and payroll system, self-service portal	Complex setup, requires training
Data-Driven Smart Manufacturing (DDSM)	✓	✓	✓	Real-Time Dashboards and Analytics, Talent Management	Sensitive data, require secure infrastructure and user access control

Zendesk distinguishes itself with its AI-driven and automated scheduling process, offering advanced capabilities for organizations looking to streamline workforce planning. However, its complexity can be a drawback, especially for teams unfamiliar with such sophisticated tools. On the other hand, iTrent is a comprehensive Human Capital Management (HCM) solution. It offers robust modules for HR, payroll, time & attendance, talent management, learning and development. The platform is known for its strong reporting tools, workflow automation, and employee self-service features, making it suitable for medium to large organizations. However, it is hard to learn to fully utilize the features that iTrent offers and the learning process can be time consuming. DDSM excels in staff scheduling as it uses AI and machine learning to match employees to tasks based on skills, availability, and safety requirements. It also has strict attendance management where employees need to make an absent application permit. Data-Driven Smart Manufacturing uses talent management to fully utilize the performance report of each of the employees.

Overall, the choice between these systems depends on organizational priorities. Zendesk suits companies seeking automation and AI integration, iTrent appeals to those needing a fully customizable workflow and comprehensive payroll system. Meanwhile DDSM is ideal for large cooperation that focuses on assigning the right workers at the right time. Each system offers unique strengths, and organizations must weigh these against their specific needs and constraints.

These comparisons contribute to identifying proven features and validating the industry standards of developing the workforce management system. The proposed system will adapt some key features to make the deliverable of events more smoothly, these key elements are such as scheduling, attendance

management and performance report by referring to the similar systems.

2.8 System Development Life Cycle (SDLC)

Methodology is an important step in project development. Choosing the right system development is a crucial part in ensuring the system development project runs smoothly and successfully. These methodologies act as guides that help planning and designing the system. By using the right approach and method in developing the project, developers can make better decisions and complex tasks. However, there are many methodologies and approaches that can be used to suit many types of project development. In this context, system development requires system development life cycle methodologies.

2.8.1 System Development Life Cycle Models Comparison

The System Development Life Cycle (SDLC) provides the fundamental stages required for building and maintaining an information system. Choosing the right development methodologies is crucial before starting system development. However, various development methodologies have been created to guide how these stages are carried out, such as the Waterfall model, Rapid application development (RAD), and the V-Model. The Waterfall model, RAD, and the V-Model were chosen for this project because each methodology provides unique advantages suitable for different phases of system development. The Waterfall model offers a structured approach for clearly defined requirements, ensuring proper documentation and straightforward progress tracking. RAD enables rapid prototyping, allowing the development team to incorporate feedback from operational managers and facilitators quickly, improving the system's usability. Meanwhile, the V-Model emphasizes verification and validation, ensuring that the recommendation engine and scheduling modules meet the system requirements and perform reliably. The selection of a methodology depends on project requirements, time constraints, and the level of flexibility needed during development.

Table 2.3 : Table of methodology comparison

Model	Approach	Stakeholder involvement	Flexibility
Waterfall Model	Linear and sequential distinct phases: requirements, design, implementation, testing, deployment. (Saravanos & Curinga , 2023)	Low (customers mainly in requirements and acceptance phases)	Very low (highly inflexible once phased)
V-Model	Sequential like Waterfall, but each development phase is paired with a corresponding testing phase (forming a “V” shape) (Leong et al. , 2023)	Low (similar to Waterfall)	Low (rigid, derived from Waterfall)
Rapid application development	Iterative, prototype-driven development (small increments with rapid prototyping) (Leong et al. , 2023)	High (continuous user feedback during prototyping)	High (quick iterations allow changes)

Based on Table 2.2, it explains the comparison of system development life cycle models between Waterfall Model, V-Model and Rapid Application Development Model. These models each have unique benefits based on their methodology, stakeholder involvement, and flexibility. The Waterfall and V-Models both use a step-by-step development process with minimal stakeholder participation, mostly in the requirement and acceptance stages. While RAD emphasizes on flexibility and quick iterations through ongoing stakeholder feedback, the V-Model improves verification by matching each development phase with a matching testing phase. Nonetheless, the Waterfall model was selected for this project because the project requirements are clearly defined and stable. Based on the preliminary interviews with the operation manager, the specific solutions required have been identified before development begins. Its sequential development guarantees meticulous documentation and methodical progress, which fits in nicely with the project's academic scope and time constraints.

2.8.2 Waterfall Model Approach



Figure 2.5 Waterfall Model Approach (Sinha & Das, 2021)

Based on Figure 2.5, the Waterfall Model approach consists of six phases. The phases are requirement, design, implementation, verification, deployment and maintenance. This model emphasizes a linear and sequential approach. According to Saravacos & Curinga (2023), The Waterfall model is a classical, linear-sequential SDLC approach in which each phase must be completed before the next begins. Despite the popularity of agile methods, many projects still adopt Waterfall when requirements are well understood. Each phase inside this model needs to be completed before moving on to the next phase. This step is crucial to keep the system development on track. However, this model has drawbacks as the phases can only move in one direction, going back is not an option. The requirement phase includes requirement elicitation to gather requirements from the stakeholder or an organization. This phase is the foundation of the system development life cycle and the initial startup to create the project.

This model gained prominence for its simplicity and structured design, making it suitable for projects with clearly defined goals and stable requirements (Khan, 2023). According to Adenowo & Adenowo (2013), the Waterfall Model divides development into requirement analysis, design, implementation, testing, deployment, and maintenance. Each phase with its own specific goals and

deliverables. Once a phase is finalized, the development process does not return back to the previous phase, it needs to move on to the next phase. This raises problems in development teams as there can be adjustments to the requirements gathered. In fact, Saravanos & Curinga (2023) emphasizes that despite the rise of iterative methods, many organizations still use Waterfall or hybrid methods with a sequential base. The authors also stated that Waterfall Model strengths include ease of management, clear stage deliverables, and traceability through documentation, but its weakness is its poor handling of evolving requirements and late feedback. This clearly shows that it is easy to implement due to clear stages or phases that are to be thorough.

The Requirement phase is the foundation of the entire model. At this stage, developers collaborate with stakeholders to gather all relevant information about the system's desired functionalities. These requirements are formally documented in a Software Requirement Specification (SRS), which serves as the reference for all subsequent phases. The System Design phase then interprets the SRS into a technical blueprint, involving the development of data structures, architecture design, interface mockups, and database schemas.

Following design, the Implementation phase involves translating the designs into a working system through coding. Each software component is built based on the previous design documents, typically by development teams working within a defined stack or framework. Upon completion, the Integration and Testing phase ensures that all modules work together as intended. This includes unit testing, integration testing, and system-level verification to identify and resolve functional or logical errors.

Once the system is confirmed to be stable and meets the original specifications, the Deployment phase involves installing the application in a live environment, where real users begin interacting with the system. Finally, the Maintenance phase ensures that the software remains functional and relevant through bug fixes, updates, or enhancements based on user feedback and emerging needs.

Despite its historical popularity, the Waterfall Model has several limitations. It is rigid and not suited for projects that may require frequent changes or have evolving requirements. First, the requirements for the Falcon Kingdom Academy system were well understood from the outset through the Preliminary Study phase. Since the specific issues regarding facilitator assignment and payroll were clearly identified via stakeholder interviews , the project prioritizes stability over flexibility. As noted by Khan (2023), once a phase is completed, returning to make changes is difficult and often

costly. Additionally, testing occurs late in the process, which increases the risk of discovering major issues only at the end. These characteristics make the model less ideal for large-scale, dynamic, or object-oriented software development (Adenowo & Adenowo, 2013).

Furthermore, the strict linear structure of the Waterfall Model ensures discipline and on-time delivery , which aligns with the fixed academic timeline of this Final Year Project. The Waterfall Model remains valuable in contexts where requirements are well understood from the outset and stability is prioritized over flexibility. When project requirements are clear and unlikely to change, Waterfall's discipline can help ensure on-time delivery. It is often applied in government, manufacturing, or embedded systems projects, where change is minimized, and documentation is essential. As such, it continues to be an important reference point in software engineering literature and practice.

2.9 Summary

Managing the workforce effectively is essential for any organization, as employees play a vital role in driving success. In the context of Falcon Kingdom Academy, the academy manages a large and diverse pool of facilitators, making it difficult for the operation department to assign roles accurately, track attendance, evaluate performance, and process payments efficiently.

Workforce management systems usually help with scheduling, task assignment, and performance tracking. This project goes a step further by incorporating a recommendation system that suggests the right facilitators for the right roles based on their skills, experience, and past performance. Among various techniques, content-based filtering was chosen because it works well in environments where individual profiles are detailed, and where privacy or limited data makes collaborative methods less effective.

Finally, the system will be developed using the Waterfall model. This approach was selected for its clear, step-by-step structure, which fits well within the academic project timeline and the clearly defined requirements. While it's not as flexible as some modern methods, Waterfall allows for detailed planning and documentation making it a strong choice for this type of system development.

CHAPTER 3

METHODOLOGY

This chapter provides the information of chosen methodology for development phases of this project. It also gives the details of the activities held in each of the system development phases.

3.0 Executive Summary

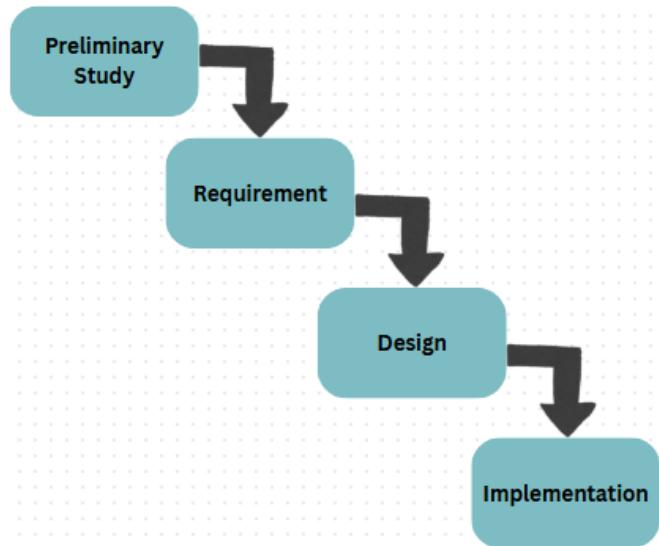


Figure 3.0 Modified Waterfall Model

Figure 3.0 shows that the modified Waterfall Model starts with preliminary study to make a feasibility study by identifying whether the project is doable. This initial phase usually conducts basic requirement research to identify the problem statement from the stakeholder, project scope and project objective. Next, the requirement phase takes place to analyze requirements documented that are gathered during requirement elicitation. A structured interview can be conducted to retrieve requirements needed for design and development. Then, it continues to the design phase where designing visuals or diagrams are needed to make it as the blueprint for the implementation phase. It

includes designing the system architecture, database schemas and sequence diagrams. The visuals and diagrams are created based on the requirements that are documented during the requirement phase. Moving on to the implementation phase where the actual system development takes place. The system will be built based on the design documents that are created. Lastly, system development completion, system validation with the stakeholder will be held at the end of this phase.

Table 3.1 Modified Waterfall Model System Development Lifecycle

Phase	Activity	Techniques/Tools	Deliverable	Objective
Preliminary Study	1. Identify Project problem identification. 2. Conduct Preliminary interview with Operation Manager and Facilitator from Falcon Kingdom Academy. 3. Make literature review on project title. 4. Choose system development life cycle models to suit with the project	Preliminary Interview	Project Proposal	To identify the requirements for workforce management system for Falcon Kingdom Academy
Requirement	1. Interview with Operation Manager and Facilitator from Falcon Kingdom Academy 2. Analyze interview session using content analysis 3. Create use case	1. Semi-structured interview 2. Document Analysis 3. Google Docs 4. Content Analysis	1. Functional requirements 2. Use Case Diagram 3. Use Case Description 4. Domain Class Diagram 5. System Requirement Specification	

	<p>diagram</p> <p>4.Create use case description</p> <p>5.Design Domain Class Diagram</p> <p>6.Document requirements in SRS</p>			
Design	<p>1. Design Design Class Diagram</p> <p>2. Design User Interface</p> <p>3. Design Database</p> <p>4.Design rule-based expert system logic to decide facilitators</p> <p>5.Created System Design Document</p>	<p>1.Draw.io</p> <p>2. Figma</p> <p>3. Google Docs</p>	<p>1.Design Class Diagram</p> <p>2. Data Dictionary</p> <p>3.System Design Document</p>	To design the workforce management system for Falcon Kingdom Academy
Implementation	<p>1.Develop the workforce management system.</p> <p>2.Develop rule-based expert system logic to decide facilitators</p>	<p>1.Visual Studio Code</p> <p>2. GitHub</p>	<p>1. Workforce Management System</p> <p>2. Database</p> <p>3. Functioning rule-based expert system logic</p>	To develop the workforce management system for Falcon Kingdom Academy

3.1 Preliminary Study

The preliminary study is critical before proceeding in analysing requirements. It works as a foundation for starting to develop the project. Before gathering the requirements, a preliminary interview is done with the stakeholder to identify the core problems and current activity process. After that, construct the project objectives to plan the results of this project.

As for this project, the preliminary interview was conducted with the Falcon Kingdom Academy operation manager to understand the current process of handling the workforce of facilitators and matching facilitators with events created. The current activity processes conducted raises a few problems that can be solved by creating the workforce management system. This foundation acts as a startup to build up requirement gathering after understanding the scope, problem statement and objectives of the workforce management system.

3.1.1 Preliminary Interview with Stakeholder

In a preliminary interview with the logistic manager, Mr Qawiem, which is one of the operation departments inside Falcon Kingdom Academy, it is done to grasp the current situation and problem that is currently facing during managing the workforce to distribute tasks for event or program execution. With a grasp of the situation, more questions can be constructed to create more precise scope for creating the solution. By understanding the current situation, understanding the source of the issue which is the problem that causes difficulties in handling the workforce. Hence, the problem statement for this project can be defined and the project scope can be identified.

Additionally, the preliminary interview also contributes in defining the scope of this project. This system was developed specifically for the operation department to help manage the workforce of facilitators.

3.1.2 Project Problem Identification

Identifying the project problem is the first step before analyzing the problem further. Based on the preliminary interview conducted with the logistic manager, the problem statements have been identified. The problem statement is the difficulty in role assignment for event facilitators. The

organization primarily uses WhatsApp as their main communication and management tool to manage their own current facilitators. The next problem statement is difficulty in performance tracking. Currently, the organization has no records of facilitator performance to keep track on. Furthermore, the next problem is regarding the salary payment delay as there are many facilitators among the workforce that are yet to receive their salary accurately.

3.1.3 Literature Review on Project Title

Literature review is essential for any academic project, so does this final year project. Understanding the background of the project title is crucial as it helps in developing the knowledge in the area. Literature is needed to gain knowledge regarding the theories, techniques and technologies that are related to the workforce management system. Analyzing articles and research papers helps in identifying the elements of the workforce management system and grasp a better understanding in the existing systems.

3.1.4 Choosing System Development Life Cycle Model

This project uses the Waterfall Model as the SDLC approach. The Waterfall Model is a linear and sequential model that only increments when each phase is completed. This model is suitable for projects that have defined requirements, problem statement, scope and objectives from the beginning. The traditional Waterfall Model phases involve Requirement, Design, Implementation, Verification and Deployment. However, adjusting to this project, changes are made to suit the project. The Modified Waterfall Model includes one phase before Requirement, which is Preliminary Study for understanding the problem statement before gathering requirement and removes one phase after Implementation which is Verification,

3.1.5 Project Proposal Preparation

Project proposal preparation is outlining all the important aspects of the project, starting from project background, project objectives, problem statements, project scope and project significance. Then, making a literature review on the project topic to understand the background of the topic, supporting the choice made and learning from existing solutions. Then, explaining the Waterfall Model approach as the methodology chosen for developing the project. 3.2 Requirement

The requirements that have been elicited from the stakeholders need to be analysed and documented. This process leads to making progress and making sure the project development keeps on track and aligns with the requirements. The functional and non-functional requirements are elicited, analysed, and documented to provide a clear understanding of what the system should do. This ensures the stakeholders have a mutual understanding and helps avoid scope creep. A system requirement specification is made as a result of requirement documentation.

3.2 Requirements

3.2.1 Requirements Gathering

Relevant data is collected using the requirements elicitation techniques such as document analysis and interview. The requirements are gathered from Falcon Kingdom Academy by conducting a semi-structured interview, which is provided by interviewing the operation manager himself, Mr. Qawiem. Meanwhile, the requirements about the facilitator are collected by interviewing Mr. Shafiq, who is a facilitator in Falcon Kingdom Academy.

The semi-structured interview method was applied by preparing a set of guiding questions related to events , facilitator assignment, attendance tracking, and payment workflow. These questions served as the main structure of the interview, ensuring that all important topics were covered. However, during the interview, additional follow-up questions were asked based on the interviewee's responses to gather deeper insights or clarify unclear information.

3.2.2 Analyze Requirements

After relevant information that has been gathered, it needs to be analyzed to ensure the requirements are clear and complete. Analyzing the requirements helps in defining the features and identifying the requirements that are out of project scope.

3.2.3 Requirements Documentation

Requirements that have been elicited, gathered and analyzed need to be documented in one documentation. Separate requirements into categories such as functional requirements and non-functional requirements. The use case diagram will be created to describe the functional requirements inside the workforce management system. Additionally, define the interactions between

the actors and the system. Include use case descriptions to define the use case diagram and the flow of activity between the actor and the workforce management system.

3.3 Design

The design phase transforms the requirements documented into a blueprint for building the system. In this phase, it involves designing the module of the workforce management system. Designing the domain class diagram to represent the concept of relationship and designing the content based filtering gives a blueprint to the development process for understanding the flow of the filtering process. The entity relationship diagram models the structure of the database by showing the tables, attributes, functions and relationships. Plus, a data dictionary will also be included to understand the data type, field size, data description and example. Additionally, this phase also involves the selection of system development framework to be used.

Tools that were used in this phase are Draw.io, for designing the domain class diagram, entity relationship diagram and system architecture diagram. Following with the usage of Microsoft Word, to construct the System Design Document to document all the designs and diagrams. The deliverables of this phase will be the Design Class Diagram, Entity Relationship Diagram, Data Dictionary and the System Design Document. At the end of this phase, the objective of this design phase is to design the structure of a workforce management system for Falcon Kingdom Academy.

3.4 Design rule-based expert system logic

The core of the intelligent workforce management system is the Inference Engine. Unlike statistical models, this engine utilizes the Forward Chaining strategy, where known facts (Event Criteria) are passed through a sequence of logical production rules to infer a valid list of candidates.

3.4.1 Process Flowchart

The following flowchart illustrates the decision-making process the system performs for every recommendation request..

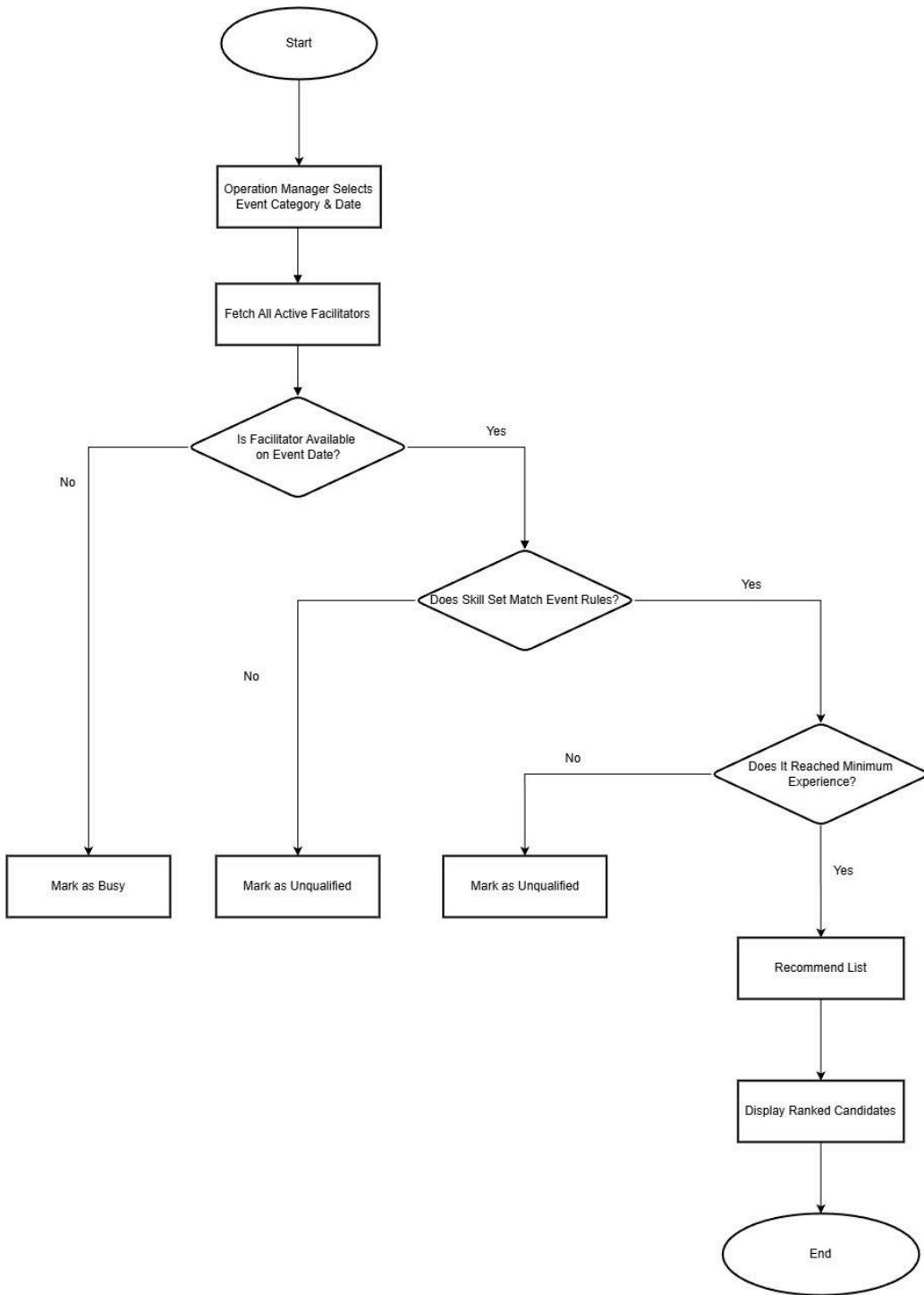


Figure 3.1 Flowchart of Rule-Based System for Facilitator Filtering

Based on Figure 3.1, the inference process initiates when the Operation Manager selects a specific event category and date range, triggering the system to retrieve all active facilitators from the database. The first filtering stage evaluates the availability of each candidate by cross-referencing the requested dates with their existing assignments and approved leaves; if a conflict is detected, the

facilitator is marked as busy and excluded from further processing. Candidates who are available then proceed to the competency mapping stage, where the system compares their recorded skill set against the specific production rules defined for the selected event category. Facilitators lacking the necessary skills are marked as unqualified. The remaining candidates undergo a final heuristic check to ensure they meet the minimum experience requirements, particularly for high-risk event categories. Those who satisfy this safety constraint are added to the valid recommendation list. Finally, the system calculates a suitability score for each qualified candidate, ranks them in descending order of suitability, and displays this prioritized list to the manager, concluding the decision-making process.

3.4 Implementation

During the implementation phase, the actual coding of the system takes place. Design documents during the design phase are used to write the source code using appropriate programming languages, tools, and frameworks. The outcome of this phase is a working workforce management system that aligns with the specified requirements. The development of the workforce management system for Falcon Kingdom Academy will be starting off with developing the content-based filtering method to recommend the right facilitator for each event.

The intent of working on a content-based filtering method is to ensure that it is functioning and solves the problem statement. The programming language that will be used in this project will be Python for the content-based filtering, PHP for the backend and the frontend. Moreover, the database will be developed using MySQL and managed by using phpMyAdmin to store all the data such as facilitator attendance, information, and events. The deliverables that will be expected from this phase are the database of the workforce management system, a fully functioning workforce management system for Falcon Kingdom Academy, and the content-based filtering facilitator recommender.

3.4.1 Development of Rule-Based Inference Engine to Generate Facilitators

The development of the rule-based recommendation method focuses on matching facilitators to events by applying a forward-chaining inference strategy against a structured Knowledge Base. In this project, the recommendation model is designed to deterministically identify valid and qualified facilitators for a newly created event based on specific hard constraints (Availability and

Competency) and soft constraints (Quality Scoring) encoded directly in the system logic.

The process begins with extracting structured features from facilitator profiles, specifically: current assignment status, skill tags, years of experience, and average performance ratings. Unlike statistical models that rely on probability, this system uses Production Rules (IF-THEN logic) to strictly validate whether a facilitator meets the safety and operational criteria of the event.

The inference engine processes these attributes through a Multi-Stage Filtration Mechanism:

1. Availability Filtering (Hard Constraint): The system first queries the schedule of each facilitator. It cross-references the requested event dates against all existing assignments and approved leaves. Any facilitator who is already committed to another event or who is on approved leave during the target dates is immediately flagged as 'busy' and excluded from the available pool to prevent scheduling conflicts.
2. Competency Mapping (Skill Constraint): The system maps the specific Event Category to a predefined set of mandatory skills stored in the knowledge base. For example, a 'HOLIDAY' event requires specific skills such as 'Swimming' and 'Medic', while a 'CAMP' event requires 'Survival' and 'Trekking'. The system scans the facilitator's skill tags; candidates must possess relevant skills to be considered fully qualified. If a candidate possesses zero matching skills for the category, they are marked as 'unqualified'.
3. Safety & Heuristic Verification (Experience Rule): To ensure operational safety, the system applies heuristic rules based on the event's intensity. For high-risk event categories (specifically 'CAMP' and 'HOLIDAY'), the system enforces a "Minimum Tenure Rule". Facilitators with less than 2 years of tenure are automatically rejected for these specific categories, ensuring that only seasoned staff handle critical safety roles.
4. Suitability Scoring (Quality Rule): Finally, rather than sorting by rating alone, the system calculates a composite suitability score for each qualified candidate to optimize the recommendation. This is calculated using a weighted formula that prioritizes high-performance history (Performance Rating) while giving additional weight to candidates who possess a higher number of relevant skills for the specific data. The final list is presented to the Operation Manager sorted by this score in descending order.

3.5 Project Timeline

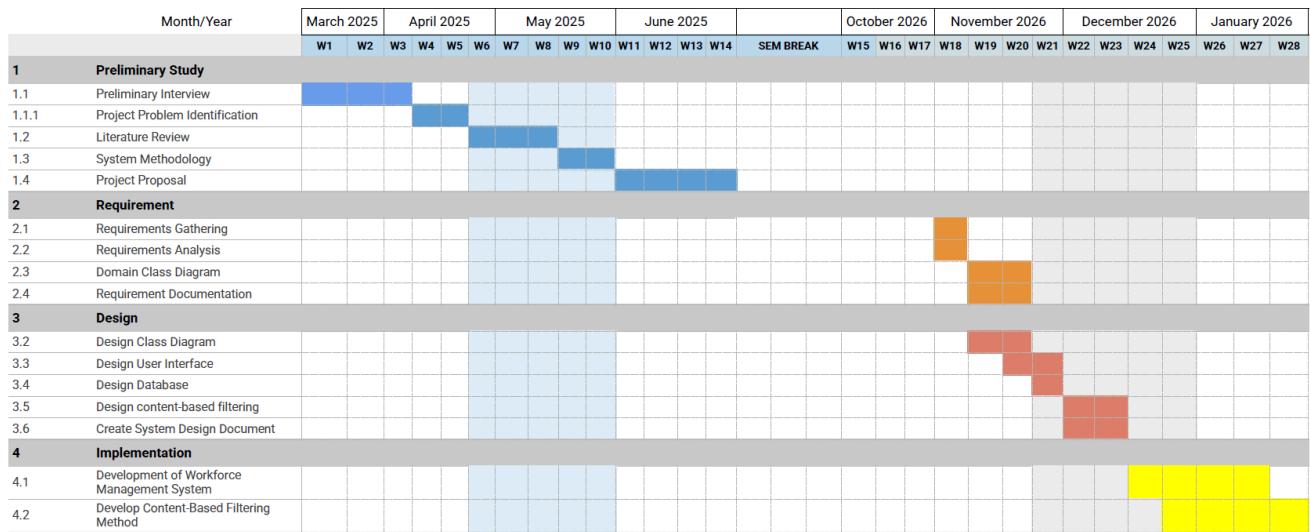


Figure 3.2 : Gantt Chart of Project Timeline

3.6 Summary

This project follows the Modified Waterfall Model to develop a Workforce Management System for Falcon Kingdom Academy. The development process began with a Preliminary Study, including stakeholder interviews to identify key issues in current workforce handling such as role assignment difficulties, lack of performance tracking, and salary payment delays.

Following that, the Requirements Phase involved gathering, analyzing, and documenting both functional and non-functional requirements through interviews and brainstorming sessions. This ensured that the system design aligns precisely with stakeholder expectations.

The Design Phase translated the requirements into technical blueprints such as domain class diagrams, ER diagrams, and system architecture, using tools like StarUML and documented in a System Design Document.

In the Implementation Phase, the system is built using Python for the rule-based filtering recommendation function, PHP for the web application, and MySQL for the database. This phase aims to deliver a fully functional system that efficiently manages facilitators, matches them to events, and stores relevant workforce data.

By adhering to the structured Waterfall model, this project ensures clarity, traceability, and alignment with the defined objectives to solve existing operational challenges.

CHAPTER 4

ANALYSIS AND FINDINGS

This chapter provides information on the results of requirements gathering from the stakeholder.

4.1 Requirement Gathering & Analysis

The requirements gathered are for the development of Workforce Management System using Content-Based Filtering. The requirements are gathered by using an interview session with the stakeholder, which was Operation Manager and Facilitator. The interviews are analysed using content analysis to find the user, requirement, business rules, and domain. The domain is also identified to construct the domain class diagram later after the use case has been completed.

4.1.1 Results of Demographic Interview Session

This section reveals the answers that are received from the interview. A preliminary interview was conducted on 25th November 2025, with the operation manager, Mr. Muhammad Qawiem Mustaqim bin Kamrizal and facilitator, Mr. Muhammad Shafiq Shauqi bin Mohd Kamar. The interview was held to gain information regarding the facilitator management processes and the flow of facilitator assignment. The full transcript of the interview can be accessed under Appendix F and Appendix G.

OM = Muhammad Qawiem Mustaqim bin Kamrizal

FC = Muhammad Shafiq Shauqi bin Mohd Kamar

Table 4.1 : Business Process & Operational Workflow Analysis and Requirements

Question ID	Question	Answer	Analysis	Requirement
Q01-OM	Can you briefly explain the business that Falcon Kingdom Academy is doing?	Falcon Kingdom Academy is a training consultancy under MH Kingdom Empire specializing in motivational events, such as team building and workshops. We currently manage a workforce of approximately 190 permanent and freelance facilitators to execute these programs.	-N/A-	-N/A-
Q02-OM	How frequent an event is created in a month?	While the exact number varies by season, the frequency is high enough that our current manual processes for scheduling and tracking have become inefficient. We have daily operational needs involving scheduling and workforce allocation.	-N/A-	-N/A-
Q03-FC	Can you describe your role and responsibilities as a facilitator in Falcon Kingdom Academy events?	My job is to execute the programs on the ground. This includes attending the venue, setting up the necessary equipment, organizing the activities for participants, and ensuring the event runs smoothly until the closing ceremony.	List of User: - Operation Manager - Facilitator Domain : - User	Actor : - Facilitator - Operation Manager

4.1.2 Requirement Elicitation and Analysis

This section explains the questions and answers that explain the problem that arise in the company

Table 4.2 : Requirement Extraction and Analysis from Interview Session

Question ID	Question	Answer	Analysis	Requirement
Q04-OM	Can you describe your main responsibilities in managing facilitators for events?	As the operation manager, my main responsibilities include assigning facilitators to events, managing their schedules, tracking attendance, and ensuring each event has the right number of facilitators based on the event requirements. I also have to confirm if the facilitators really attended the event and ensure payment details are collected for processing.	List of User: Operation Manager Domain : User	Actor : Operation Manager List of requirement: <ul style="list-style-type: none">- Assign Facilitator to Event- Manage Facilitator Schedule- Track Facilitator Attendance- Ensure right amount of facilitator assigned- Validate facilitator attendance- Collect facilitator payment details
Q05-OM	Who is responsible for creating the events?	The Marketing Manager is responsible for creating the events. They are the ones who plan the events, design the programs, and promote the details on social media to attract clients.	List of User: Marketing Manager Domain : User	Actor : Marketing Manager <ul style="list-style-type: none">- Create Event
Q06-OM	Can you explain the flow of the activity from creating events until the completion of the events?	The process starts with the Marketing Manager creating the event and blasting the details to social media. Once that is done, Operation Manager takes over. I assign tasks to the committee, calculate costs and equipment, and arrange the	List of User: <ul style="list-style-type: none">- Marketing Manager- Operation Manager- Facilitator Domain:	Actor : Marketing Manager <ul style="list-style-type: none">- Create Event Actor : Operation Manager <ul style="list-style-type: none">- Assign Task to Committee- Arrange Tentative Schedule

		tentative schedule. During the event, the facilitators join, attend the venue, set up equipment, and organize the activities. After the event closes, facilitators clock out and fill in a bank detail form via WhatsApp to get paid. Finally, I have to validate their attendance manually and prepare the payment.	- User	<ul style="list-style-type: none"> - Validate attendance - Prepare payment <p>Actor : Facilitator</p> <ul style="list-style-type: none"> - Clock out - Fill in bank detail form
Q07-FC	What processes do you follow when you are assigned to a new event?	I wait for the tentative schedule. On the event day, I go to the venue, set up equipment, run the activities, and finally clock out and submit my bank details for payment processing.	List of User : <ul style="list-style-type: none"> - Facilitator <p>Domain :</p> <ul style="list-style-type: none"> - User - Attendance 	Actor : Facilitator <ul style="list-style-type: none"> - View Event Tentative - Clock out - Submit Bank Details
Q08-FC	How are you usually informed or selected to join an event?	The details are blasted on our main WhatsApp group. If I am selected, the Operation Manager assigns me to a specific committee group for that event.	List of User : <ul style="list-style-type: none"> - Operation Manager - Facilitator <p>Domain :</p> <ul style="list-style-type: none"> - User 	-N/A-
Q09-OM	Is the operation manager involved in managing the events?	Yes, I am involved after the event is created. My role is to handle workforce planning, assigning facilitators, preparing logistics, and coordinating on-ground operations during the event	List of User: <ul style="list-style-type: none"> - Operation Manager <p>Domain :</p> <ul style="list-style-type: none"> - User 	Actor : Operation Manager <ul style="list-style-type: none"> - View Event Details - Assign Facilitator to Specific Roles
Q10-FC	What steps do you take to confirm your	I usually reply in the WhatsApp group to confirm I am available and acknowledge	List of User: <ul style="list-style-type: none"> - Facilitator 	Actor : Facilitator <ul style="list-style-type: none"> - Accept Event Assignment

	participation in an event?	the task assignment.	<p>Domain :</p> <ul style="list-style-type: none"> - User - Assignment <p>Business Rules:</p> <ul style="list-style-type: none"> - Facilitator must respond to event assignment in the system 	
Q11-FC	How do you currently submit your attendance or task completion?	Attendance is submitted using the Whatsapp live location feature. For task completion, I must fill in a bank detail form in the WhatsApp chat after the event is over.	<p>List of User :</p> <ul style="list-style-type: none"> - Facilitator <p>Domain:</p> <ul style="list-style-type: none"> - Attendance - User <p>Business Rules:</p> <ul style="list-style-type: none"> - Facilitator need to fill in bank detail form after completed the event - Facilitator must verify their attendance 	<p>Actor : Facilitator</p> <ul style="list-style-type: none"> - Verify Attendance Submission
Q12-FC	How do you report any issues or feedback after the event?	We usually just discuss it when we meet each other or message each other in the group. There is no proper form or system to give performance feedback of other facilitators, so sometimes issues and feedback are usually forgotten.	<p>Domain : PerformanceFeedback</p> <ul style="list-style-type: none"> - feedbackDetails - rating <p>Business Rules:</p> <ul style="list-style-type: none"> - Facilitator can only rate other facilitators after event is completed 	<p>Actor: Facilitator</p> <ul style="list-style-type: none"> - Feedback form to report issues after event
Q13-FC	From your experience, how could these	The most tiring part is filling in the bank details manually after every single	<p>List of User :</p> <ul style="list-style-type: none"> - Facilitator 	<p>Actor : Facilitator</p> <ul style="list-style-type: none"> - Store facilitator bank details in

	operations be done more efficiently?	event. It is repetitive. A system that saves my details would be much better. Also, there could be a better way to attend events, instead of constantly sharing live location when clocking in and filling in the clock in and clock out time.		- their profile - Clock in and Clock out using Image
Q14-FC	What information would you like to view in the system?	As a facilitator, I want to see my payment status, attendance record and my past event history records.	List of User: - Facilitator Domain : - Facilitator	Actor : Facilitator - View Payment Status - View attendance records - View past event history records

4.1.3 Mapping Interview Results with Rule-Based Logic

Table 4.3 : Rule-Based Logic Interview Results

Question ID	Question	Answer	Analysis	Requirement
Q15-OM	What problem do you personally face when you handle that many facilitators?	Currently, I often have to rely on assumptions or my own memory when assigning tasks, which unfortunately leads to frequent wrongly assigned roles. For example, I might assign someone to a technical role when their strength is actually in public speaking.	List of User : - Operation Manager Domain : - User	Actor : Operation Manager - Assign Facilitator
Q16-OM	Could a facilitator recommender make the assigning facilitator	Yes, absolutely. With a workforce of approximately 190 facilitators, it is	List of User : Operation Manager	Actor : Operation Manager - Generate recommendation

	process easier?	becoming impossible for me to manually remember the specific skills, strengths, and past performance of every single individual.	Domain: Facilitator Attributes : - skills - experience - pastperformance	for suitable facilitators
Q17-OM	To make an accurate recommendation, what specific information from a facilitator's profile should the system compare against the event requirements?"	"First, I want to be able to check their skills list. Then, I read their past experience description to see if they have handled similar events before. I also want to check if they have any specific certifications like a first-aid certificate."	Domain: Facilitator 1. skills 2. experience 3. certifications Domain: Event 1. eventDescription	Actor : Operation Manager - Generate Recommendation based on event and facilitator details
Q18-FC	There is no platform that stores your own information, would it be nice if there is one that stores your own information for assignment purposes?	"Currently, there is no such place that stores our own information. However, if it is needed for the operation manager to assign us to the event, it is nice because each facilitator will be treated fairly."	List of User : Facilitator Domain : Facilitator	Actor: Facilitator - Store facilitator information
Q19-OM	If two facilitators have similar skills, how should the system decide who appears at the top of	"I want the system to prioritize facilitators who have a higher Average Performance Rating. A 5-star facilitator should always	List of User :	Actor : Operation Manager - Prioritize higher average performance rating

	the recommendation list?	<p>be recommended before a 3-star one, even if their skills are the same."</p>	<ul style="list-style-type: none"> - Operation Manager Domain : Facilitator - averageRating <p>Business Rules:</p> <ul style="list-style-type: none"> - The recommender should always recommend a higher rated facilitator than a lower facilitator. 	facilitators
Q20-OM	What happens if a facilitator is sick or already booked for another event on that day?	"The system must not recommend anyone who is already working on that date. Also, facilitators should be able to apply for leave. If they are on approved leave, they should be automatically excluded from the recommendation list."	<p>List of User:</p> <ul style="list-style-type: none"> - Facilitator - Operation Manager <p>Domain : Leave</p> <ul style="list-style-type: none"> - Start Date - End Date - Status <p>Business Rules:</p> <ul style="list-style-type: none"> - Facilitator can apply leave - System shall not recommend facilitator that has same leave date with event date 	<p>Actor: Facilitator</p> <ul style="list-style-type: none"> - Request Leave <p>Actor: Operation Manager</p> <ul style="list-style-type: none"> - Approve Leave

Q21-OM				
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4.1.4 The Business Rules and Constraints

This section explains the business rules and constraints of domains to understand the limitations and the requirements of the system.

Table 4.4 Interview Questions and Answers about the business rules and constraints.

Question ID	Question	Answer	Analysis	Requirement
Q21-OM	Are the facilitators allowed to join more than one event in a day?	The facilitator can not attend two events at one time. Unless the event time and date does not overlap.	List of User: - Facilitator Domain: - User - Event Business Rules: - Facilitator can attend more than one event on one day, but the event date and time must not overlap - The event can be	Actor : Facilitator

			attended by more than one facilitator.	
Q22-OM	Is there a limit to how many facilitators can join a specific event?	We will specify a quota. Once that number is reached, no more facilitators should be able to join.	<p>Domain:</p> <ul style="list-style-type: none"> - Event <p>Business Rules:</p> <ul style="list-style-type: none"> - Each event have their own quota 	<ul style="list-style-type: none"> - N/A -
Q23-OM	Who is allowed to edit or delete an event if the details change?	Only the Marketing Manager should have the ability to create, edit, or delete events. The Operation Manager and Facilitators should only be able to view the details.	<p>List of User:</p> <ul style="list-style-type: none"> - Marketing Manager <p>List of Domain:</p> <ul style="list-style-type: none"> - User - Event <p>Business Rules:</p> <ul style="list-style-type: none"> - Only Marketing Manager can manage the event - Operation Manager and Facilitator can only view the event. 	<p>Actor:</p> <ul style="list-style-type: none"> - Marketing Manager <p>List of Requirement:</p> <ul style="list-style-type: none"> - Create Event - Edit Event - Delete Event - View Event Details <p>Actor:</p> <ul style="list-style-type: none"> - Facilitator - Operation Manager <p>List of Requirements:</p> <ul style="list-style-type: none"> - View Event Details

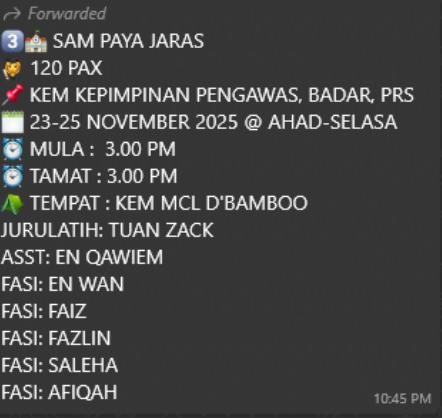
Q24-OM	<p>What criteria do you think is applicable for events to implement rules to decide which facilitator can be chosen by the system?</p>	<p>The applicable criteria for choosing a facilitator include verifying their schedule availability, ensuring they possess the required skills and experience for the specific event category, and prioritizing facilitators with a history of high performance ratings.</p>	<p>List of Domain : Skills Attributes: Skill Name</p>	<p>List of Requirement: Prioritize Facilitators with high performance ratings.</p>
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4.1.4 Documents Gathered From Falcon Kingdom Academy

During the requirement elicitation phase, a meeting was conducted with the Operation Manager of Falcon Kingdom Academy to understand the existing business processes. As a result of this session, four key documents were obtained, ranging from digital correspondence (WhatsApp) to promotional materials (posters). These artifacts were analyzed to identify necessary data attributes and domain requirements for use case diagram, use case descriptions and domain class diagram.

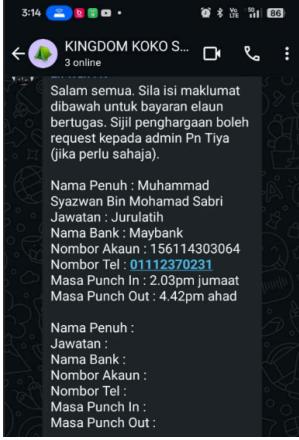
Table 4.5 : Documents List

Document ID	Document	Analysis	Requirement
DC-01	Facilitator Assignment	Domain : Event	-N/A-

	 <p>This document shows the details of the event and facilitator that are assigned.</p>	<p>Attributes:</p> <ol style="list-style-type: none"> 1. School Cooperation 2. Total Participants 3. Program Name 4. Start and End Date 5. Start and End Time 6. Event Venue <p>Domain : Facilitator</p> <ol style="list-style-type: none"> 1. Coach Name 2. Assistant Name 3. Facilitators Name 	
DC-02	Employee Clock In using Live Location	<p>User : Facilitator</p> <p>Domain : Attendance</p> <p>Attributes:</p> <ul style="list-style-type: none"> - Clock In Time - Employee Name 	-N/A-

	 <p>This document reveals the way of employee clock in to the event venue using live location in Whatsapp</p>	<p>Domain : Event</p> <p>Attributes:</p> <ul style="list-style-type: none"> - Remark 	
DC-03	Event Posters	<p>Domain : Event</p> <p>Attributes :</p> <ul style="list-style-type: none"> - Event Name - Event Venue - Event Date - Event Price - Event Image - Total Participants 	-N/A-

		<p>Business Rules:</p> <ul style="list-style-type: none"> - An event can have a limit of participants. 	
DC-04	Allowance Payment Form	<p>List of User : Administrator, Facilitator</p> <p>Domain : Payment</p> <p>Attributes :</p> <ol style="list-style-type: none"> 1. Name 2. Bank Name 3. Account number 4. Telephone Number 	<p>Requirement :</p> <ol style="list-style-type: none"> 1. Request Payment 2. Request Certificate of Appreciation

			<p>5. Punch In Time</p> <p>6. Punch Out Time</p>	
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4.1.5 Result from Requirement Analysis

This section provides information extracted from the interview conducted with Operation Manager and Facilitator. After analyzing both the interview questions and the documents that relate to the workforce management system, a list of use cases, domain list, attributes, requirements and the business rules.

Table 4.6 : List of use cases derived from interview content analysis

User	Requirement	Use Case
Marketing Manager	<ul style="list-style-type: none"> ● Create Event ● Delete Event ● View Event Details 	Manage Event
	Login	Login Account
Operation Manager	<ul style="list-style-type: none"> ● Assign Facilitator to Event ● Scheduling Facilitators ● Ensure the right amount of facilitator assigned 	Assign Facilitator
	<ul style="list-style-type: none"> ● Track Facilitator Attendance ● Validate Facilitator Attendance ● Update Facilitator Attendance 	Manage Attendance
	● Collect Payment Details	Manage Payroll
	Generate recommendation for suitable facilitators	Recommend Suitable Facilitators
	Login	Login Account
	View Event Details	Manage Event
Facilitator	<ul style="list-style-type: none"> ● View Assigned Roles ● Accept Event Assignment 	Confirm Event Participation

	View Event Tentative <ul style="list-style-type: none"> ● Clock In Attendance ● Clock Out Attendance ● View Attendance Record ● Verify Attendance Submission 	Manage Event
	<ul style="list-style-type: none"> ● Clock In Attendance ● Clock Out Attendance ● View Attendance Record ● Verify Attendance Submission 	Manage Attendance
	Fill In Feedback Form	Submit Feedback Form
	Edit Profile	Update Profile
	<ul style="list-style-type: none"> ● Submit Bank Details ● View Payment Status ● Request Allowance Payment 	Manage Payroll
	Request Leave	Apply Leave
	Register Account	Register Account
	View Past Event Involved	View Past Event

Explanation 4.7

Table 4.7 : List of domain,attributes and business rules derived from interview content analysis

Domain	Attributes	Business Rules
Facilitator	<ul style="list-style-type: none"> - Experience - Average Rating - Bank Name - Bank Account Number - Phone Number - Join Date - Username - Password 	<ul style="list-style-type: none"> - Facilitators need to capture their own image for attendance - Facilitators can only view the event tentative once assigned to event - The facilitator can view the roles that they have been assigned. - Facilitators need to decide before accepting the event assignment. - Facilitators need to capture their own image after completing the event. - Facilitators need to fill in their bank details.

		<ul style="list-style-type: none"> - Facilitators can see their own payment status of each event. - Facilitators can see their past event attendance. - Facilitators can request their allowance payment. - Facilitators can request their own certification of appreciation
User	<ul style="list-style-type: none"> - Username - Password - Email - Role 	<ul style="list-style-type: none"> - Marketing Manager can create many events - One event created by one Marketing Manager - Operation can only view the event details of available event
Event	<ul style="list-style-type: none"> - Event Name - Venue - Event Description - Event Category - Required Skill Tag - Status - Quota - Start Date Time - End Date Time - Remark 	<ul style="list-style-type: none"> - The number of assigned facilitators must not exceed the specified quota - End Date must be after Start Date - Event status must be completed before facilitators can receive certificate or payment. - The event must have at least one skill tag defined to generate facilitator recommendation. - The event can be attended by more than one facilitator.
Skills	-Skill Name	<ul style="list-style-type: none"> - One Skill can be owned by many facilitators - One facilitator can have many skills
EventRule	<ul style="list-style-type: none"> - Event Category - Required Skill - Minimum Experience - Minimum Rating 	-N/A-
Attendance	<ul style="list-style-type: none"> - Clock In Time - Clock Out Time - Status - Image Proof 	<ul style="list-style-type: none"> - Facilitators must clock in before event time. - Facilitators must take their own picture during clock in and clock out.
Assignment	<ul style="list-style-type: none"> - Date Assigned - Role 	<ul style="list-style-type: none"> - Facilitator must respond to event assignment in the system - Facilitator can attend more than

		one event on one day, but the event date and time must not overlap
Payment	<ul style="list-style-type: none"> - Amount - Payment Status - Payment Date 	<ul style="list-style-type: none"> - Payments are done after the event is completed
Leave	<ul style="list-style-type: none"> - Start Date - End Date - Status - Reason 	<ul style="list-style-type: none"> - Facilitator can apply leave - System shall not recommend facilitator that has same leave date with event date
PerformanceFeedback	<ul style="list-style-type: none"> - Rating Score - Feedback Comment 	<ul style="list-style-type: none"> - Facilitator need to give feedback after event is completed

- Production Rules

The Knowledge Base is encoded using standard Production Rules in the form of IF <Condition> THEN <Action>. These rules are grouped by the 5 Event Categories defined in the System Design.

Table 4.8 Category Specific Competency Rules

Condition(IF)	Condition(THEN - Required Skills)
TEAM BUILDING	{Speaking, Medic, Leadership, Facilitating}
TALK	{Speaking, Leadership, Public Speaking, Facilitating}
CAMP	{Medic, Speaking, Leadership, Hiking, Trekking, Motivation, Religious, Survival, Logistics}
WORKSHOP	{Speaking, Teaching, Survival, Archery, Facilitating, Time Management, Leadership, Organization Management, Logistics}
HOLIDAY	{Medic, Swimming, Logistic}

Table 4.9 Category Specific Experience Rules

Condition(IF - Minimum Experience)	Condition(THEN - Event Category)
MORE THAN AND EQUAL 2 Years	{CAMP, HOLIDAY, TEAM BUILDING, TALK, WORKSHOP}
No Minimum Years	{TEAM BUILDING, TALK, WORKSHOP}

Table 4.10 General Availability Rules

Condition(IF - Availability)	Action (THEN - Status)
Facilitator has Assignment overlapping with Event Start/End	Busy
Facilitator has Approved Leave overlapping with Event Start/End	Busy
Facilitator has No Overlaps AND Meets Skill/Experience Rules	Available

4.1.6 Requirement Modelling

Based on the gathered requirements, the project moved into the modeling phase by creating a Use Case Diagram and a Domain Class Diagram via draw.io. The Use Case Diagram is designed to illustrate the system's capabilities and user interactions. In this visual model, the system's limits are marked by a rectangle, while users are depicted as stick figures outside these limits.

Table 4.11 List of Use Case with corresponding use cases

Use Case ID	Use Case
UC-100	Register Account
UC-200	Login Account
UC-300	Update Profile
UC-400	Manage Event
UC-500	Assign Facilitator
UC-501	Recommend Suitable Facilitators

UC-501	Manage Payroll
UC-600	Manage Profile
UC-700	Respond to Assignment
UC-800	Submit Feedback Form
UC-900	View Past Event
UC-1000	Manage Facilitator Account
UC-1100	Register Account
UC-1200	Manage Leave
UC-1300	Apply Leave

With the use cases that have been identified, the modelling of the use case diagram has been constructed. The use case diagram is constructed from requirement analysis and document review.

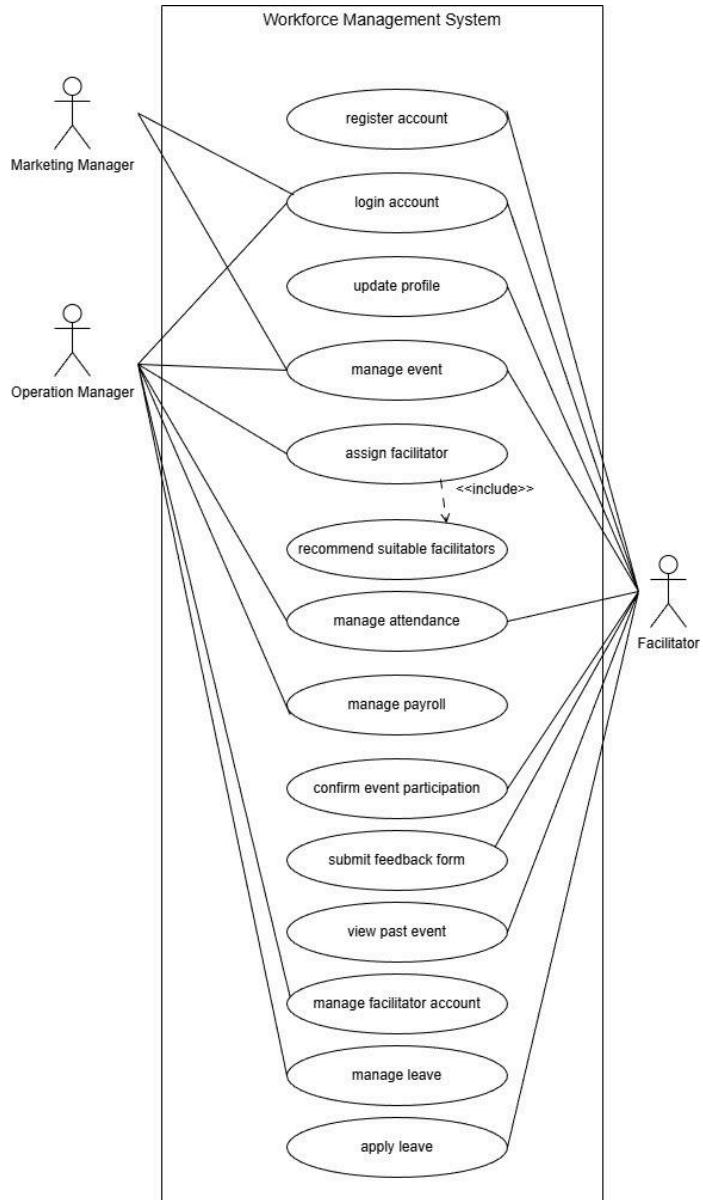


Figure 4.1 : Use Case Diagram of Workforce Management System

4.1.7 Use Case Description

Table 4.12 Use Case Description List

Use Case	Description
Register Account	Facilitator creates new account
Login Account	Allows user to choose Facilitator, Operation Manager or Marketing Manager to log into system
Update Profile	Facilitators can update their own profile by filling in their bank details, skills and experience.

Manage Event	Allows the Marketing Manager to create, update, delete, and view event details. Operation Manager and Facilitator can only read the event details.
Assign Facilitator	The Operation Manager selects specific facilitators for an event.
Recommend Suitable Facilitators	Operation Manager uses a Rule-Based Logic algorithm to suggest suitable facilitators based on their skills, experience and availability.
Manage Attendance	Handles the tracking of facilitator attendance, then allows the Operation Manager to validate these records for payments.
Manage Payroll	Operation Manager processes allowance payments based on validated attendance records.
Confirm Event Participation	Facilitators receive new event job offers and can choose to either accept or decline the assignment.
Submit Feedback Form	Facilitators can submit feedback forms to comment on other facilitator's behaviour and give rating to other facilitators.
View Past Event	Facilitators can view a history of the events they have been involved in.
Manage Facilitator Account	Operation Manager can create, update and delete facilitator account
Manage Leave	The Operation Manager can update leave request status, view and delete facilitator's leave requests.
Apply Leave	Facilitator apply for leave

Table 4.13 Use Case Description Assign Facilitator

UCID	UC-500	
Use Case Name	Assign Facilitator	Created by: Amir Afham

Scenario	The Operation Manager assigns and selects the suitable facilitator	
Triggering Event	An event is created	
Brief Description	The Operation Manager assigns facilitators to specific roles.	
Actor	Operation Manager	
Related Use Cases	UC-201 : Generate Recommendation	
Stakeholders	Operation Manager , Facilitator	
Preconditions	1. The event must exist 2. Facilitators must have registered to the system	
Post conditions	1. Facilitators are selected to an event	
Flow of Activities	<i>Actor</i>	<i>System</i>
	2. Clicks available event 5.1. Selects one or multiple facilitators 5.2. Click “Assign Facilitator” button 6.1 Clicks “Get Recommendation” button 7.1. Chooses facilitator for the event	1. Shows list of events available 3. Displays event details 4. Shows “Assign Facilitator” button 5. Shows list of facilitator names. 6. Shows “Get Recommendation” button 7. Shows recommended facilitator names. 8. Receives facilitator details 9. Verify facilitator information 10. Assign facilitator to an event ID 11. Saves facilitator assignment in database
Exception Conditions	E1: If the facilitator is already assigned to an event with a clash date, the system warns “Already Assigned to an event”.	
Special requirements / Business Rules	Facilitator is unable to be assigned to an event that overlaps with an existing assignment.	
Assumptions	- Not applicable -	
Notes and issues	- Not applicable -	

Table 4.14 Use Case Description Recommend Suitable Facilitators

UCID	UC-501	
Use Case Name	Recommend Suitable Facilitators	Created by: Amir Afham
Scenario	The system calculates the best facilitator match for an event.	
Triggering Event	Operation Manager clicks “Get Facilitators” button	
Brief Description	The system uses Content-Based Filtering to match event requirements with facilitator skills.	
Actor	Operation Manager	
Related Use Cases	UC-200 : Assign Facilitator	
Stakeholders	Operation Manager	
Preconditions	<ol style="list-style-type: none"> 1. Facilitator with Skills 2. Event with Skill Tags 	
Post conditions	<ol style="list-style-type: none"> 1. A list of recommended facilitator is shown 	
Flow of Activities	<i>Actor</i>	<i>System</i>
Normal flow/ Valid flow	1. Clicks “Recommend Suitable Facilitator” for an event	<ol style="list-style-type: none"> 1. 2. Analyze event category and requirements 2. 3. Retrieve all Facilitator 3. 4. Filters by Skills matched 4. 5. Filters by Availability 5. 6. Filters by Experience 6. 7. Ranked by average rating 7. 8. Displays list of “Recommended Facilitators”
Exception Conditions	E1 : If no facilitators are matched, system displays “No skill matched facilitators are found”	
Special requirements / Business Rules	- Not applicable -	

Assumptions	- Not applicable -
Notes and issues	- Not applicable -

Table 4.15 Use Case Description Submit Feedback Form

UCID	UC-900					
Use Case Name	Submit Feedback Form	Created by: Amir Afham				
Scenario	Facilitator provides performance rating to other facilitators and give comments					
Triggering Event	Facilitator completes an event					
Brief Description	Give rating out of 5 and textual comments					
Actor	Facilitator					
Related Use Cases	- Not applicable -					
Stakeholders	Facilitator, Operation Manager					
Preconditions	1. Facilitator must have attended the event.					
Post conditions	1. Feedback record is saved and linked to the Event ID.					
Flow of Activities	<table border="1"> <thead> <tr> <th><i>Actor</i></th> <th><i>System</i></th> </tr> </thead> <tbody> <tr> <td>1.0. Clocks out the attended event 3.1. Fill in feedback form 3.2. Click “Send” Button</td> <td>2.0. Shows feedback form (facilitatorName, rating, comments). 3.3. Verify the data 3.4. Sends data to database 4. Recalculates average rating for facilitators</td> </tr> </tbody> </table>	<i>Actor</i>	<i>System</i>	1.0. Clocks out the attended event 3.1. Fill in feedback form 3.2. Click “Send” Button	2.0. Shows feedback form (facilitatorName, rating, comments). 3.3. Verify the data 3.4. Sends data to database 4. Recalculates average rating for facilitators	
<i>Actor</i>	<i>System</i>					
1.0. Clocks out the attended event 3.1. Fill in feedback form 3.2. Click “Send” Button	2.0. Shows feedback form (facilitatorName, rating, comments). 3.3. Verify the data 3.4. Sends data to database 4. Recalculates average rating for facilitators					

Exception Conditions	- Not applicable -
Special requirements / Business Rules	- Rating must be in integer 1 to 5
Assumptions	- Not applicable -
Notes and issues	- Not applicable -

4.1.8 Domain Class Diagram

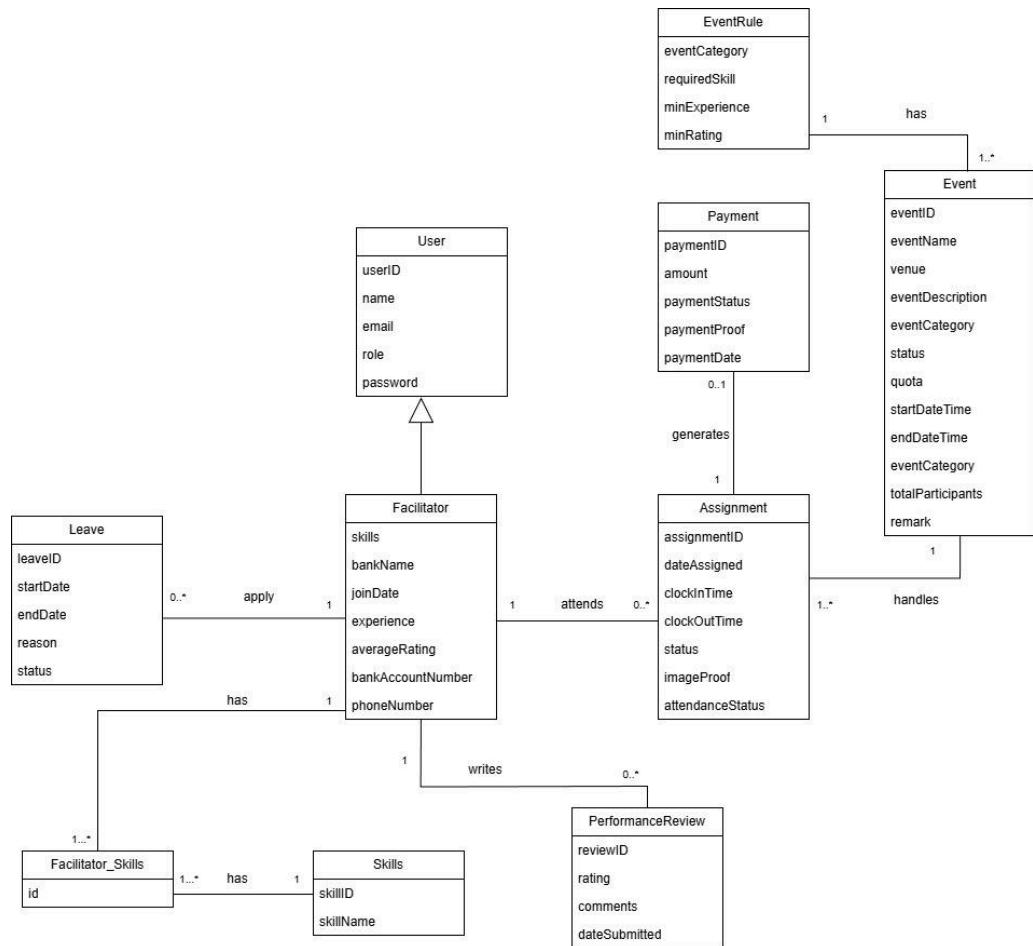


Figure 4.2 : Domain Class Diagram of Workforce Management System using Rule-Based System

Logic

Based on Figure 4.2, The Domain Class Diagram is the structural planning of the Workforce Management System that visualizes how the Rule-Based Logic plans data to implement safety standards and ease the operations. It starts with the User as a superclass to gain access to a system which is isolated from the basic authentication information to domain specific attributes in the Facilitator subclass such as skills and the day they joined. The essence of this work is presented in the form of the Assignment entity that operates as a connection between Facilitators and Events which

associates with the lifecycle of the work such as attendance and clock in hours. To be able to back the expert system logic, the EventRule class serves as a separate Knowledge Base that holds a set of fixed safety requirements such as the necessary abilities, in which all Events follow a set of standardized policies towards automated suggestions. Lastly, the system incorporates the Payment entity that creates the financial record when work is confirmed to be done and the Leave class that is needed when the work has been assigned to determine the availability of the facilitator to ensure no conflicts are made during the inference process.

4.2 The Design of Workforce Management System

After the requirements have been identified and analyzed, the next phase starts off with designing the whole system. Starting from the design class diagram until the design of the rule-based expert system logic itself. The design phase acts as the blueprint for the development of the Workforce Management System using Rule-Based Expert System Logic.

4.2.1 Design Class Diagram

After the domain class is constructed and the domains have been identified, before starting developing the system, the detailed design class diagram is created to be the blueprint for the development of the system.

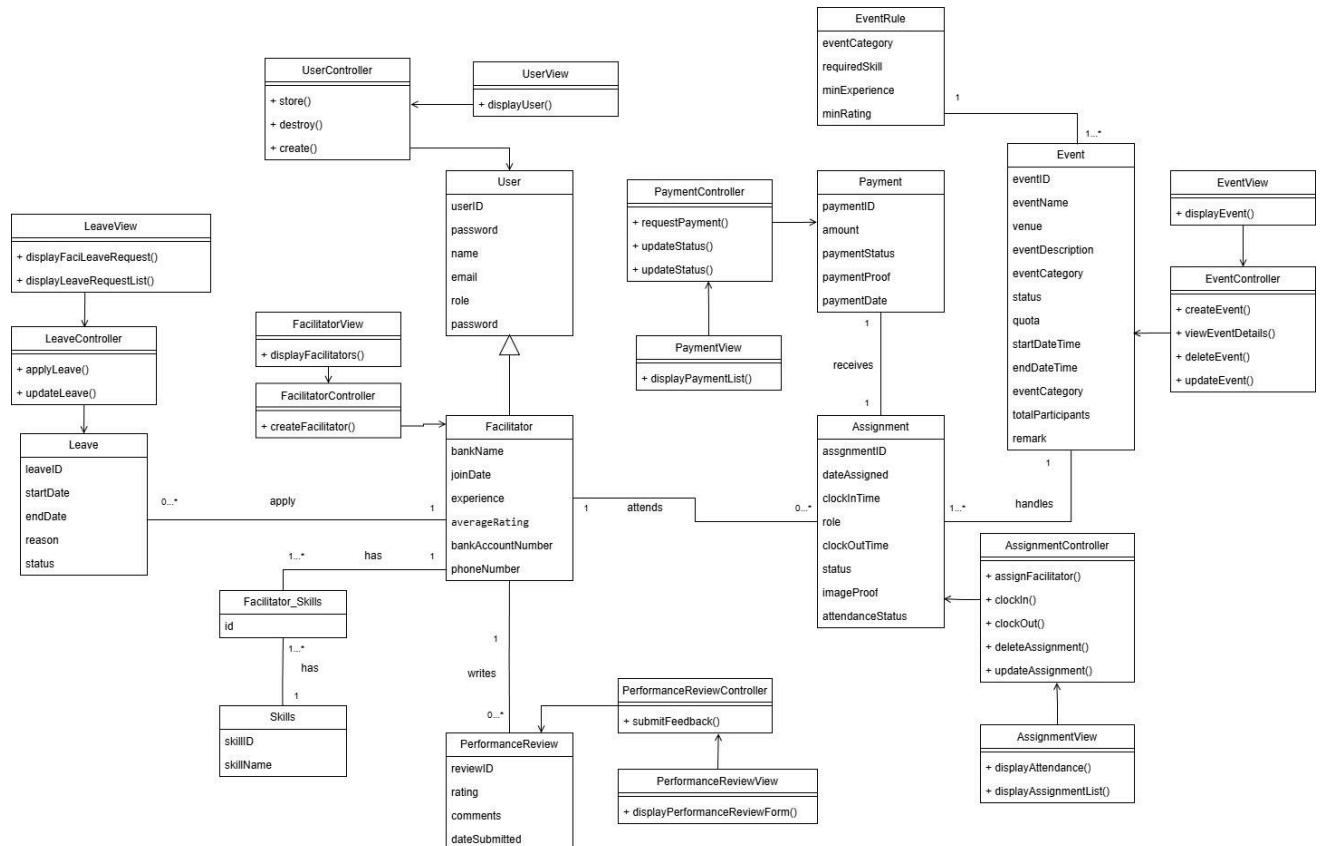
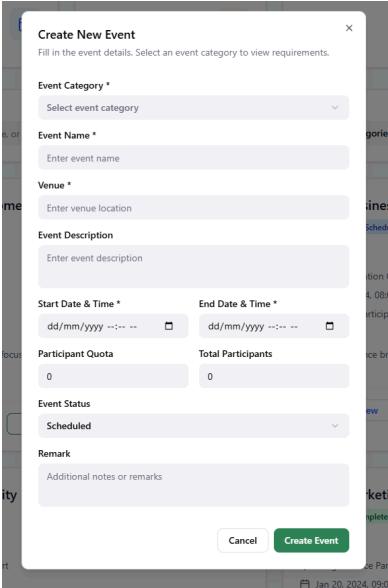


Figure 4.3 : Detailed Design Class Diagram

4.2.2 User Interface Design

Table 4.16 List of User Interface Designs

Use Case ID	Use Case Name	Functional Requirement	Related User Interface	Description
UC-100	Manage Event	Create Event		This interface allows Marketing Manager to create event

	Update Event		This interface allows Marketing Manager to update existing event
	Delete Event		This interface allows Marketing Manager to delete events.

View Event Details

The screenshot shows the FalconWFM interface for a Marketing Manager. The left sidebar has a blue header with the FalconWFM logo and navigation links for Events, Assignments, Facilitators, and Report. The main area is titled "Event List" with a sub-header "List of available events". It shows four events: "Annual Leadership Summit", "Digital Transformation Workshop", "Customer Service Training", and "Innovation & Creativity Forum". Each event card includes a brief description, date, location, facilitators assigned, capacity, and a "View Event" button.

This interface allows Marketing Manager to view event details

The screenshot shows the FalconWFM interface for an Operation Manager. The left sidebar has a blue header with the FalconWFM logo and navigation links for Events, Assignments, Facilitators, and Report. The main area is titled "Event List" with a sub-header "List of available events". It shows the same four events as the Marketing Manager's view: "Annual Leadership Summit", "Digital Transformation Workshop", "Customer Service Training", and "Innovation & Creativity Forum". Each event card includes a brief description, date, location, facilitators assigned, capacity, and a "View Event" button.

This interface allows Operation Manager to view the event details

			<p>The screenshot shows a modal window titled "Event Details" for the "Annual Leadership Summit". It displays event information: Date (2024-02-15), Time (09:00), and Venue (Convention Center, Hall A). The "Description" section states: "A comprehensive summit bringing together industry leaders to discuss emerging trends and best practices in modern workplace management." Under "Skills Required", there are buttons for Leadership, Public Speaking, Strategic Planning, and Industry Expertise. The "Role Assigned" section shows "Leadership Coach / Speaker". The "Your Response" section shows "Accepted". A "Close" button is at the bottom right.</p>	This interface allows Facilitator to view the event details
UC-200	Login Account	Login Account	<p>The screenshot shows a dark-themed login interface for "FalconForce Workforce Management System". It features a "Sign In" button at the top. Below it is a dropdown menu labeled "Choose option...", followed by "Email" and "Password" input fields. At the bottom is a "Sign in" button and a link "Don't have an account? Register here".</p>	This interface allows users to choose between Operation Manager, Marketing Manager and Facilitator for logging into the system.
UC-301	Assign	Assign Facilitator		This interface allows Operation Manager

Facilitator

The screenshot shows the Falcon Force software interface. On the left is a vertical sidebar with icons for Dashboard, Events, Facilitators, Leave, Payroll, and Logout. The main area displays event details for the "Annual Leadership Summit".

Event Details:

- Date: 15/02/2024
- Time: 09:00 - 17:00
- Location: Convention Center, Hall A
- Capacity: 500 participants

Facilitator Assignment Status:

- Progress: 2 / 2
- All positions filled
- Category: Conference

Assigned Facilitators:

Name	Email	Experience
Michael Chen	michael.chen@example.com	10 years exp. Technical Leadership
Emma Davis	emma.davis@example.com	5 years exp. Workshop Design

Event Management Summary:

- Total Events: 5
- Pending Assignment: 4
- Fully Assigned: 1

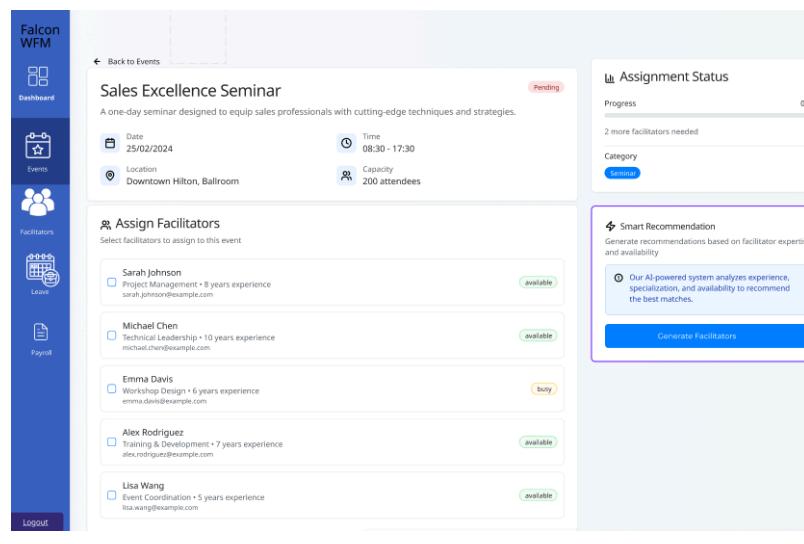
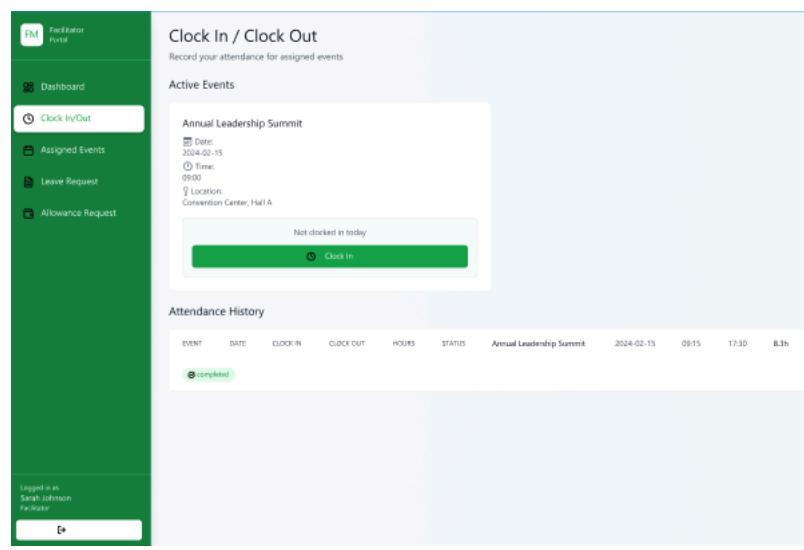
Event Details for Annual Leadership Summit:

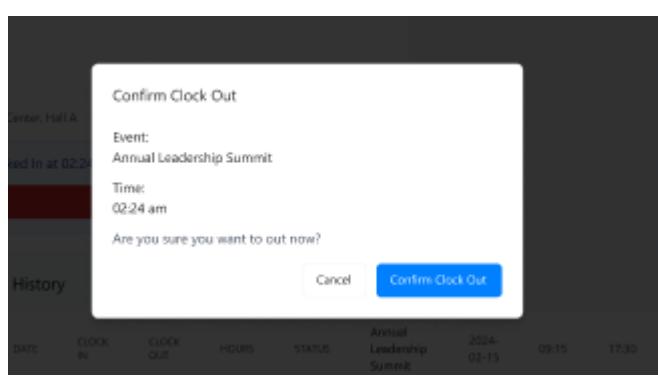
- Date: 15/02/2024
- Location: Convention Center, Hall A
- Facilitators assigned: 2 / 2
- Category: Conference
- Capacity: 500 capacity

Buttons:

- Assign Facilitators →

to assign facilitators to an event.

UC-301	Recommend Suitable Facilitators	Recommend suitable facilitators		<p>This interface allows Operation Manager to recommend suitable facilitators for an event before assigning them,</p>
UC-400	Manage Attendance	Facilitator Clock In		<p>This interface enables the facilitator to clock in for work at an event.</p>

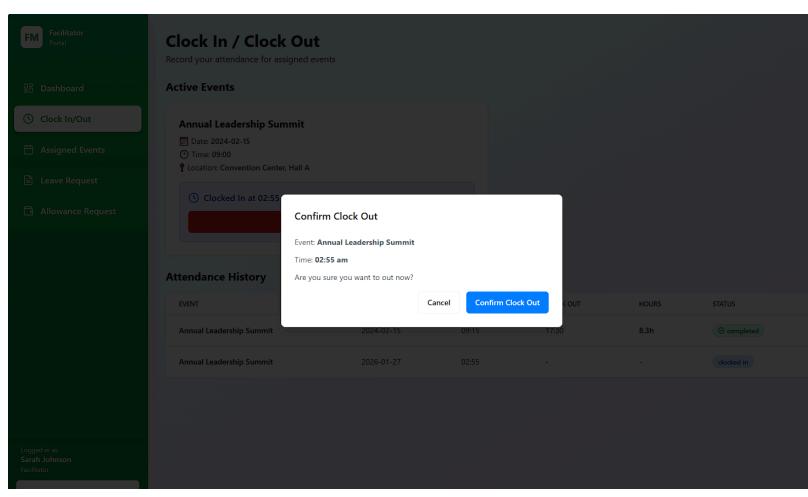
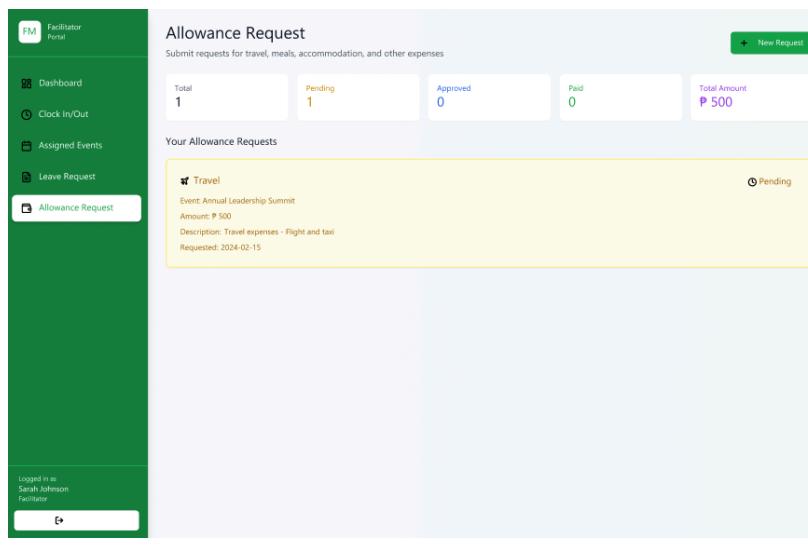


Facilitator Clock Out

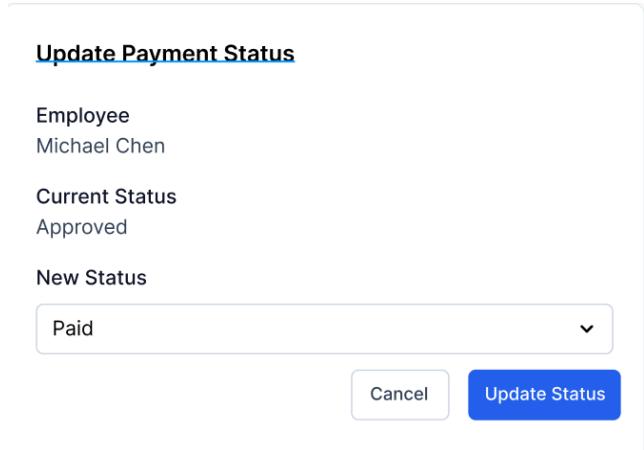
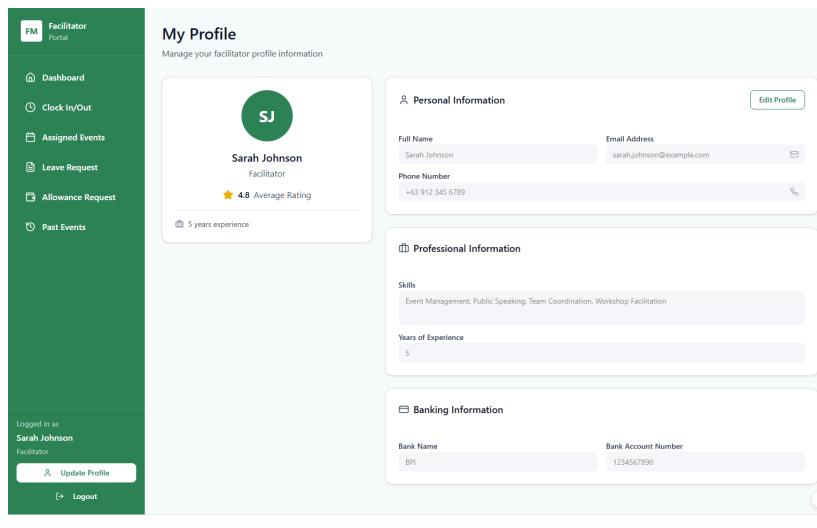
A screenshot of the 'Facilitator Portal' interface. On the left, there's a green sidebar with the FM logo and the text 'Facilitator Portal'. It has several menu items: 'Dashboard' (selected), 'Clock In/Out' (highlighted in red), 'Assigned Events', 'Leave Request', and 'Allowance Request'. Below the sidebar, it says 'Logged in as Sarah Johnson Facilitator'. The main content area has a light gray background. It shows a section titled 'Clock In / Clock Out' with the sub-instruction 'Record your attendance for assigned events'. Under 'Active Events', there's a card for 'Annual Leadership Summit' with details: Date: 2024-02-15, Time: 09:00, Location: Convention Center, Hall A. Below this is a button labeled 'Clock Out'. Under 'Attendance History', there's a table with the following data:

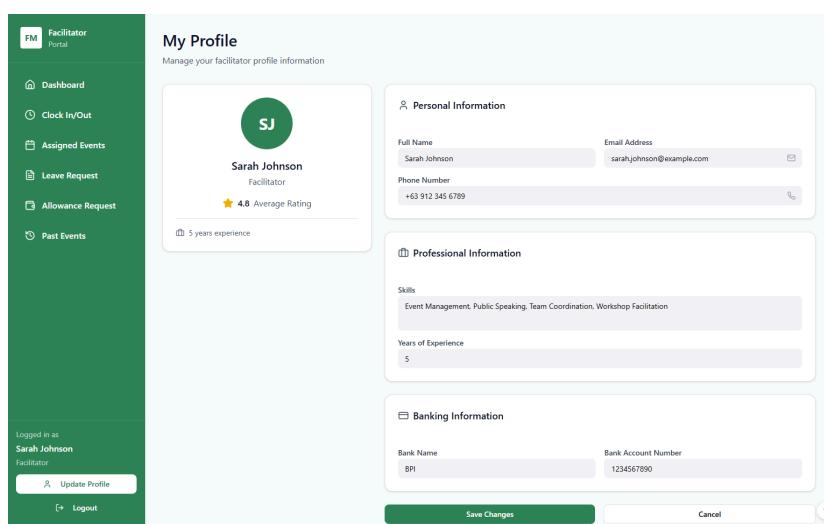
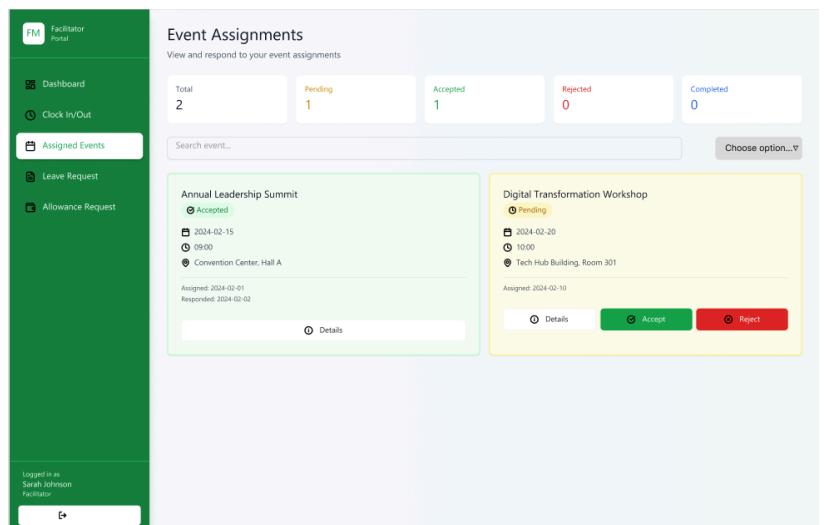
EVENT	DATE	CLOCK IN	CLOCK OUT	HOURS	STATUS
Annual Leadership Summit	2024-02-15	09:15	17:30	8.3h	completed
Annual Leadership Summit	2026-01-27	02:55	-	-	clocked in

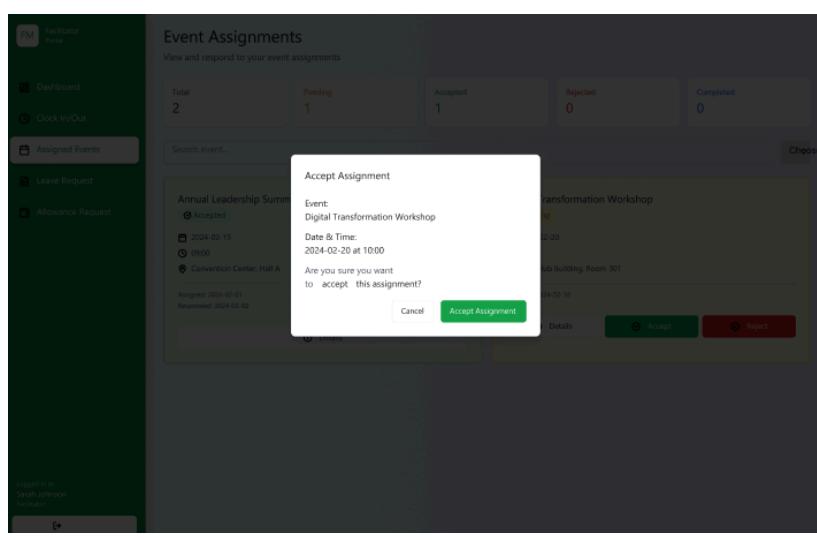
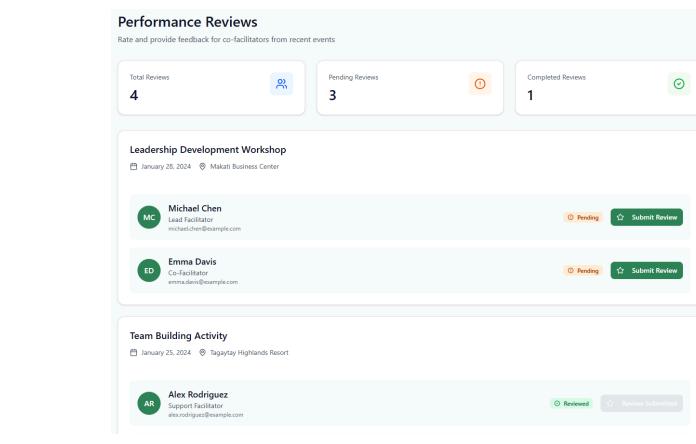
This interface allows facilitator to clock out after event is complete.

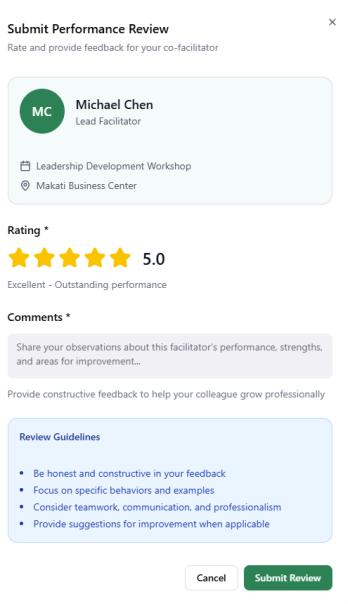
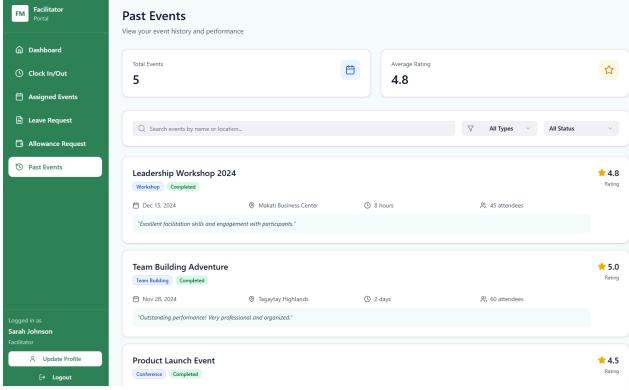
			
UC-500	Manage Payroll	Request Payment	 <p>This interface allows the facilitator to request an allowance.</p>

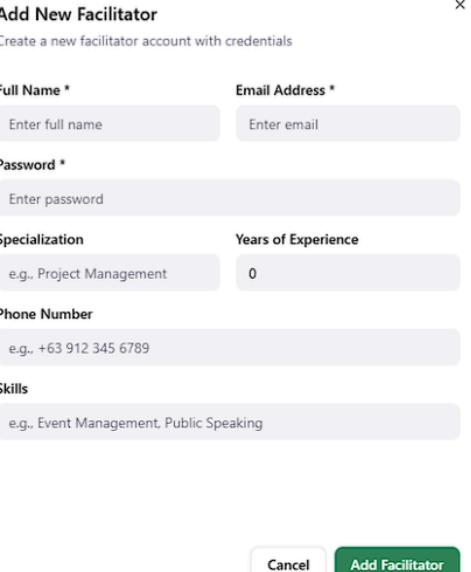
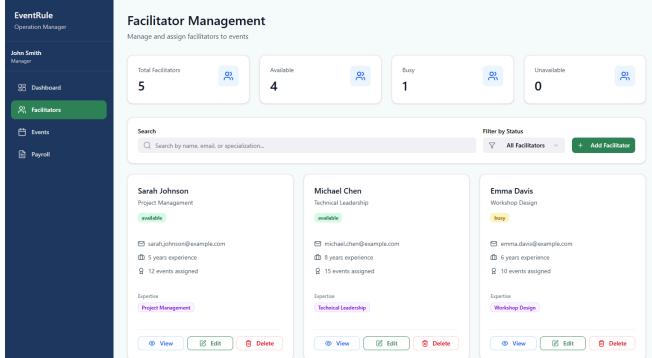
		<p>The screenshot shows the 'Allowance Request' form within the 'Facilitator Panel'. The left sidebar includes links for Dashboard, Clock In/Out, Assigned Events, Leave Request, and Allowance Request. The main area has sections for 'Submit New Allowance Request' (Event, Amount, Description), 'Your Allowance Requests' (Travel, Event: Annual Leadership Summit, Amount: ₱ 500, Description: Travel expenses - Flight and taxi, Requested: 2024-02-15), and summary statistics (Total 1, Pending 1, Approved 0, Paid 0, Total Amount ₱ 500).</p>																																											
	<h3>Update Payment Status</h3>	<p>The screenshot shows the 'Payroll Management' interface within the 'FalconWFM' system. The left sidebar includes links for Events, Assignment, Facilitators, Leave, Payroll, Import/Export, Help/Operations, Operation Manager, and Logout. The main area displays a summary of payment requests (Total Requests 5, Approved 1, Pending 2, Rejected 1) and a detailed list of individual payment requests:</p> <table border="1"> <thead> <tr> <th>EMPLOYEE</th> <th>ACCOUNT</th> <th>AMOUNT</th> <th>DATES</th> <th>STATUS</th> <th>REASON</th> <th>ACTION</th> </tr> </thead> <tbody> <tr> <td>Sarah Johnson fac_1</td> <td>****5628</td> <td>100</td> <td>2024-02-10 2024-02-10</td> <td>Pending</td> <td>Payment for Annual Leadership Summit</td> <td>Update</td> </tr> <tr> <td>Michael Chen fac_2</td> <td>****9832</td> <td>120</td> <td>2024-02-10 2024-02-12</td> <td>Pending</td> <td>Payment for Annual Leadership Summit.</td> <td>Update</td> </tr> <tr> <td>Emma Davis fac_3</td> <td>****3456</td> <td>120</td> <td>2024-02-10 2024-02-14</td> <td>Paid</td> <td>Payment for Annual Leadership Summit - Completed</td> <td>Update</td> </tr> <tr> <td>Alex Rodriguez fac_4</td> <td>****7890</td> <td>120</td> <td>2024-02-08 2024-02-11</td> <td>Rejected</td> <td>Missing required documentation</td> <td>Update</td> </tr> <tr> <td>Lisa Wang fac_5</td> <td>****2345</td> <td>120</td> <td>2024-02-12 2024-02-12</td> <td>Pending</td> <td>Payment for upcoming training session</td> <td>Update</td> </tr> </tbody> </table>	EMPLOYEE	ACCOUNT	AMOUNT	DATES	STATUS	REASON	ACTION	Sarah Johnson fac_1	****5628	100	2024-02-10 2024-02-10	Pending	Payment for Annual Leadership Summit	Update	Michael Chen fac_2	****9832	120	2024-02-10 2024-02-12	Pending	Payment for Annual Leadership Summit.	Update	Emma Davis fac_3	****3456	120	2024-02-10 2024-02-14	Paid	Payment for Annual Leadership Summit - Completed	Update	Alex Rodriguez fac_4	****7890	120	2024-02-08 2024-02-11	Rejected	Missing required documentation	Update	Lisa Wang fac_5	****2345	120	2024-02-12 2024-02-12	Pending	Payment for upcoming training session	Update	<p>This interface allows Operation Manager to update the status of facilitator payments.</p>
EMPLOYEE	ACCOUNT	AMOUNT	DATES	STATUS	REASON	ACTION																																							
Sarah Johnson fac_1	****5628	100	2024-02-10 2024-02-10	Pending	Payment for Annual Leadership Summit	Update																																							
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Emma Davis fac_3	****3456	120	2024-02-10 2024-02-14	Paid	Payment for Annual Leadership Summit - Completed	Update																																							
Alex Rodriguez fac_4	****7890	120	2024-02-08 2024-02-11	Rejected	Missing required documentation	Update																																							
Lisa Wang fac_5	****2345	120	2024-02-12 2024-02-12	Pending	Payment for upcoming training session	Update																																							

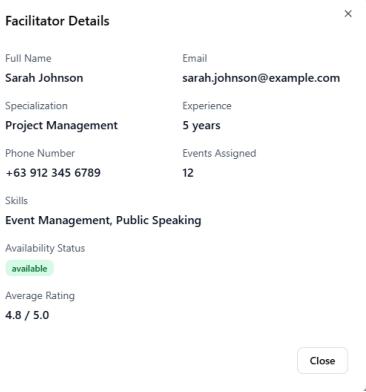
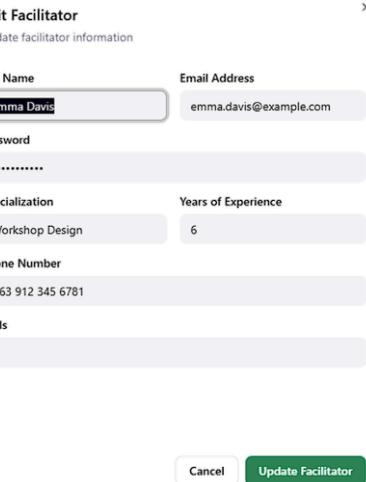
				
UC-600	Update Profile	Update Facilitator Profile		This interface allows the facilitator to edit their own profile for keeping up to date.

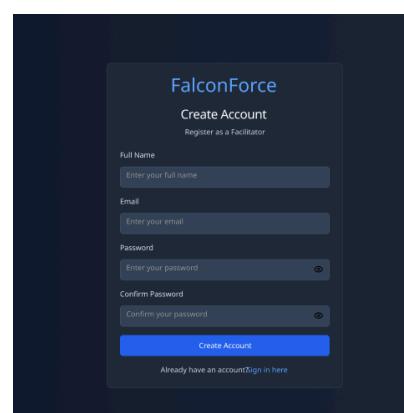
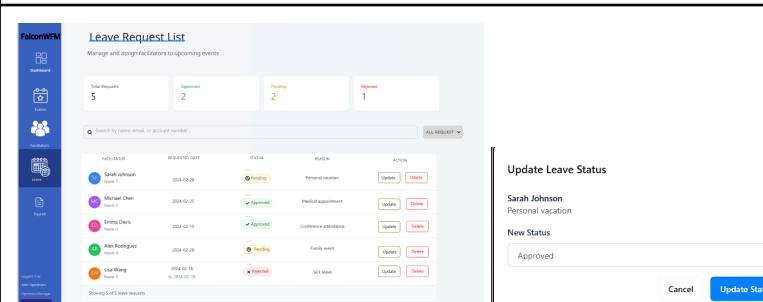
			 <p>The screenshot shows the 'My Profile' section of the Facilitator Portal. It includes a profile summary card for Sarah Johnson (Facilitator, 4.8 Average Rating, 5 years experience), sections for Personal Information (Full Name: Sarah Johnson, Email Address: sarah.johnson@example.com, Phone Number: +63 912 345 6789), Professional Information (Skills: Event Management, Public Speaking, Team Coordination, Workshop Facilitation; Years of Experience: 5), and Banking Information (Bank Name: BPI, Bank Account Number: 1234567890). Buttons for 'Save Changes' and 'Cancel' are at the bottom.</p>	
UC-700	Confirm Event Participation	Accept Event Assignment	 <p>The screenshot shows the 'Event Assignments' section of the Facilitator Portal. It displays a summary of assignments: Total 2, Pending 1, Accepted 1, Rejected 0, Completed 0. Below this, two event cards are shown: 'Annual Leadership Summit' (Accepted, Pending, 2024-02-15, 0900, Convention Center, Hall A) and 'Digital Transformation Workshop' (Pending, 2024-02-20, 1000, Tech Hub Building, Room 301). Each card has a 'Details' button and an 'Accept' or 'Reject' button.</p>	This interface enables the facilitators to decide before accepting an event assignment

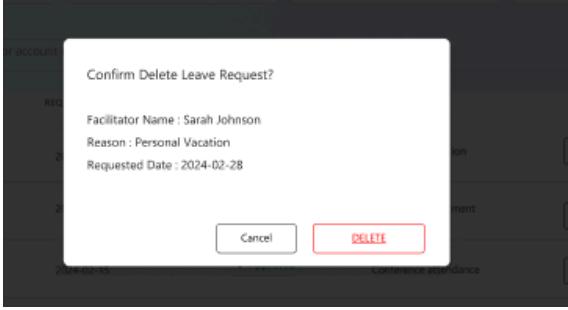
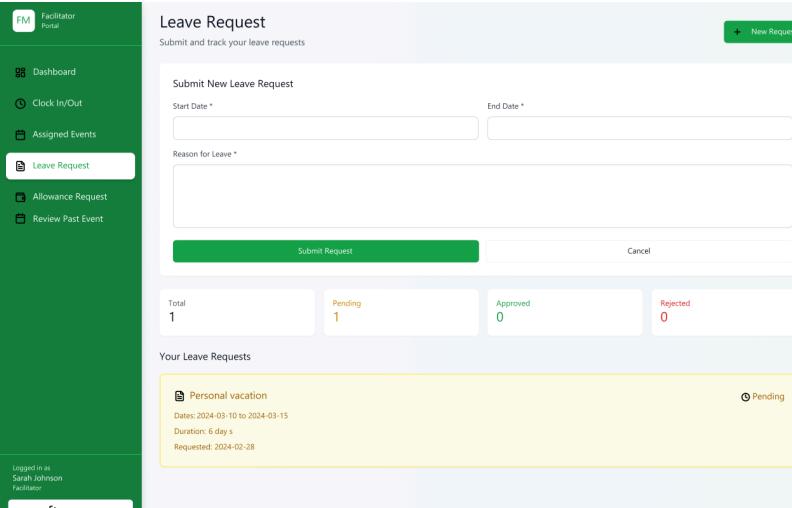
			
UC-800	Submit Feedback Form		This interface allows facilitator to give rating and comments to each other

				
UC-900	View Past Event	View previously joined events		This interface allows the facilitator to see their history of work.

UC-1000	<p>Manage Facilitator Account</p> <p>Create Facilitator account</p>		<p>This interface allows the operation manager to create accounts for facilitators.</p>
	<p>View Facilitator account</p>		<p>This interface allows the operation manager to see the details of each facilitator.</p>

		 <p>Facilitator Details</p> <table border="0"> <tbody> <tr> <td>Full Name</td> <td>Email</td> </tr> <tr> <td>Sarah Johnson</td> <td>sarah.johnson@example.com</td> </tr> <tr> <td>Specialization</td> <td>Experience</td> </tr> <tr> <td>Project Management</td> <td>5 years</td> </tr> <tr> <td>Phone Number</td> <td>Events Assigned</td> </tr> <tr> <td>+63 912 345 6789</td> <td>12</td> </tr> <tr> <td colspan="2">Skills</td> </tr> <tr> <td colspan="2">Event Management, Public Speaking</td> </tr> <tr> <td colspan="2">Availability Status</td> </tr> <tr> <td colspan="2">available</td> </tr> <tr> <td colspan="2">Average Rating</td> </tr> <tr> <td colspan="2">4.8 / 5.0</td> </tr> </tbody> </table> <p>Close</p>	Full Name	Email	Sarah Johnson	sarah.johnson@example.com	Specialization	Experience	Project Management	5 years	Phone Number	Events Assigned	+63 912 345 6789	12	Skills		Event Management, Public Speaking		Availability Status		available		Average Rating		4.8 / 5.0		
Full Name	Email																										
Sarah Johnson	sarah.johnson@example.com																										
Specialization	Experience																										
Project Management	5 years																										
Phone Number	Events Assigned																										
+63 912 345 6789	12																										
Skills																											
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Availability Status																											
available																											
Average Rating																											
4.8 / 5.0																											
	<p>Update facilitator account</p>	 <p>Edit Facilitator</p> <p>Update facilitator information</p> <table border="0"> <tbody> <tr> <td>Full Name</td> <td>Email Address</td> </tr> <tr> <td><input type="text" value="Emma Davis"/></td> <td>emma.davis@example.com</td> </tr> <tr> <td>Password</td> <td>.....</td> </tr> <tr> <td>Specialization</td> <td>Years of Experience</td> </tr> <tr> <td>Workshop Design</td> <td>6</td> </tr> <tr> <td>Phone Number</td> <td>+63 912 345 6781</td> </tr> <tr> <td colspan="2">Skills</td> </tr> <tr> <td colspan="2"><input type="text"/></td> </tr> </tbody> </table> <p>Cancel Update Facilitator</p>	Full Name	Email Address	<input type="text" value="Emma Davis"/>	emma.davis@example.com	Password	Specialization	Years of Experience	Workshop Design	6	Phone Number	+63 912 345 6781	Skills		<input type="text"/>		<p>This interface allows the operation manager to update the details of the facilitators.</p>								
Full Name	Email Address																										
<input type="text" value="Emma Davis"/>	emma.davis@example.com																										
Password																										
Specialization	Years of Experience																										
Workshop Design	6																										
Phone Number	+63 912 345 6781																										
Skills																											
<input type="text"/>																											

		Delete facilitator account	 <p>A confirmation dialog titled "Delete Facilitator" asking if the user is sure they want to delete Michael Chen. It states that this action cannot be undone. There are "Cancel" and "Confirm" buttons.</p>	This interface allows the operation manager to delete facilitator accounts
UC-1100	Register Account	Create Account	 <p>The "Create Account" form for FalconForce. It includes fields for Full Name, Email, Password, and Confirm Password. A "Create Account" button and a "Sign in here" link are at the bottom.</p>	This interface enables the facilitator to create their own account before accessing the system.
UC-1200	Manage Leave	Update leave request status	 <p>The "Leave Request List" interface shows a grid of leave requests with columns for Facilitator, Requested Date, Status, Reason, and Action. A modal window titled "Update Leave Status" is open for a specific request from Sarah Johnson, showing options to change the status to "Approved" or "Rejected".</p>	This interface enables the operation manager to manage the leave requests by facilitators.

		Delete leave request status	 A screenshot of a mobile application interface titled "Confirm Delete Leave Request?". It displays the following information: Facilitator Name : Sarah Johnson, Reason : Personal Vacation, Requested Date : 2024-02-28. At the bottom are two buttons: "Cancel" and a red-bordered "DELETE" button.	This interface allows the operation manager to delete leave requests by facilitators.
UC-1300	Apply Leave	Apply for leave request	 A screenshot of a mobile application interface titled "Leave Request". It shows a "Submit New Leave Request" form with fields for Start Date, End Date, and Reason for Leave. Below the form is a summary bar showing: Total 1, Pending 1, Approved 0, Rejected 0. At the bottom is a section titled "Your Leave Requests" showing a single entry: "Personal vacation" with dates 2024-03-10 to 2024-03-15, duration 6 day(s), and requested date 2024-02-28.	This interface allows the facilitators to apply for leave.

4.2.3 Database Design

- Relational Table

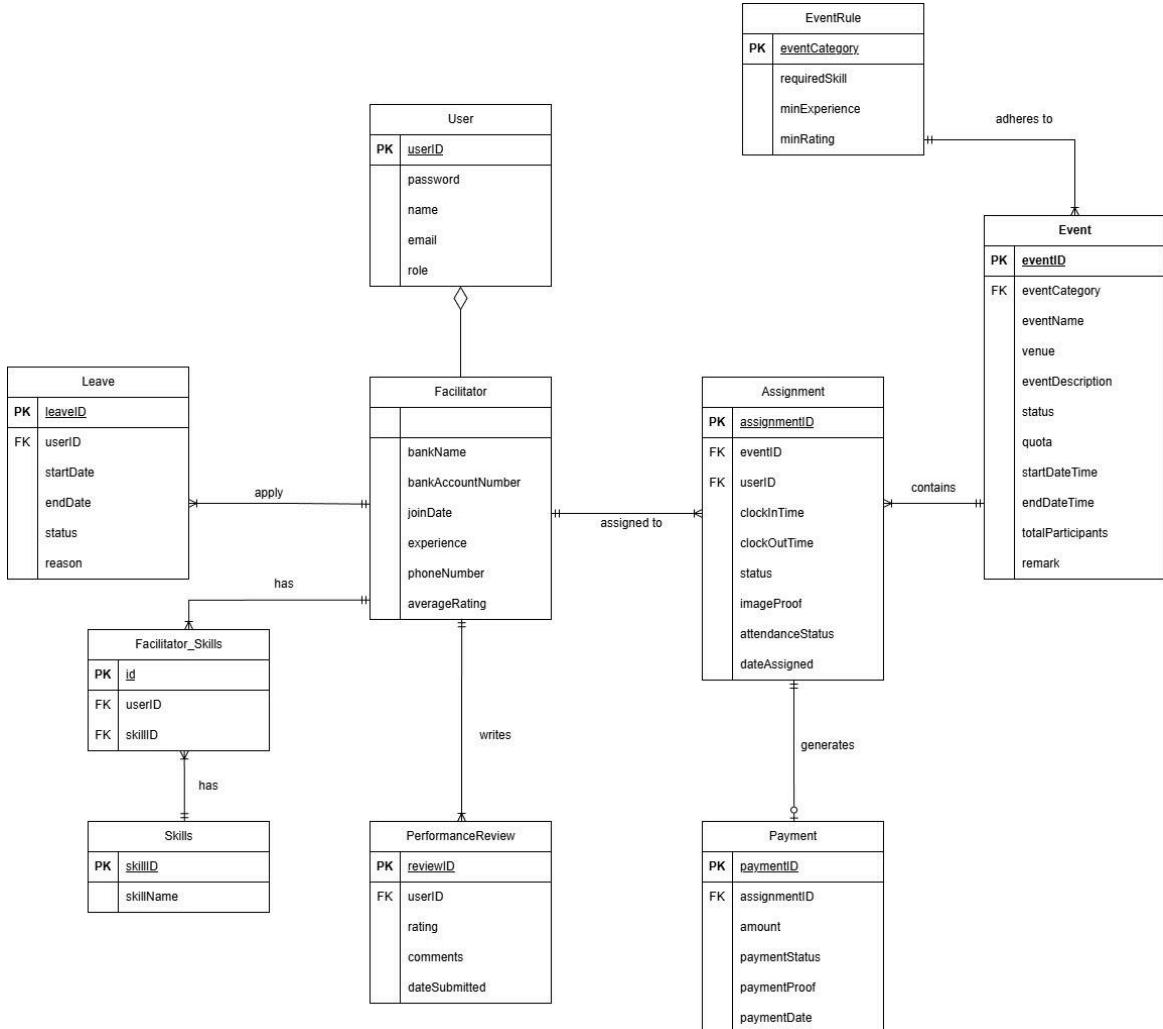


Figure 4.4 Relational Table for Workforce Management System

Figure 4.4 presents the Relational Table of the Workforce Management System for Falcon Kingdom Academy. These required data structures are conceptually represented in this figure, which is designed to support the rule-based expert system logic without being bound by specific software limitations. An online modelling tool called Draw.io was used in this development to map out the logical database design, ensuring the data structures and their connections are visually aligned with the system's entities, attributes, relationships, and cardinalities. The use of database keys is the main component of this relational design; Primary Keys (PK) are utilized to uniquely identify individual records within entities like Event and EventRule, while Foreign Keys (FK) are employed to establish essential relationships between tables, such as linking specific events to their governing safety rules to

ensure data integrity across the system.

- **Data Dictionary**

To ensure data integrity, the physical database design is supported by a detailed data dictionary that catalogs the properties of every stored element. This dictionary acted as the primary reference point for translating the conceptual design into the final database specifications.

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	id 🔑	bigint(20)		UNSIGNED	No	None		AUTO_INCREMENT	Change Drop More
□ 2	user_id 🔑	bigint(20)		UNSIGNED	No	None			Change Drop More
□ 3	skills	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 4	bank_name	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 5	bank_account_number	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 6	phone_number	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 7	experience	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 8	join_date	date			Yes	NULL			Change Drop More
□ 9	average_rating	double			No	0			Change Drop More
□ 10	certifications	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 11	created_at	timestamp			Yes	NULL			Change Drop More
□ 12	updated_at	timestamp			Yes	NULL			Change Drop More

Figure 4.5 Data Dictionary for Facilitators

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	id 🔑	bigint(20)		UNSIGNED	No	None		AUTO_INCREMENT	Change Drop More
□ 2	event_name	varchar(255)	utf8mb4_unicode_ci		No	None			Change Drop More
□ 3	venue	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 4	event_description	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 5	event_category 💬	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 6	status	varchar(255)	utf8mb4_unicode_ci		No	upcoming			Change Drop More
□ 7	quota	int(11)			No	0			Change Drop More
□ 8	start_date_time	datetime			No	None			Change Drop More
□ 9	end_date_time	datetime			Yes	NULL			Change Drop More
□ 10	required_skill_tag	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 11	remark	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 12	created_at	timestamp			Yes	NULL			Change Drop More
□ 13	updated_at	timestamp			Yes	NULL			Change Drop More

Figure 4.6 Data Dictionary for Events

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	eventCategory	varchar(255)	utf8mb4_unicode_ci		No	None			Change Drop More
□ 2	requiredSkill	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 3	minExperience	int(11)			No	0			Change Drop More
□ 4	minRating	int(11)			No	0			Change Drop More

Figure 4.7 Data Dictionary for Event Rules

4.2.4 Rule-Based Logic Design

This section details the logical conditions used by the Inference Engine to filter and rank facilitators. To ensure the system eliminates subjective bias, the logic is standardized into a Decision Matrix and an algorithmic Pseudocode.

- Decision Logic Matrix

Table 4.17 illustrates the precise combinations of conditions that determine a facilitator's eligibility status. The system evaluates these rules sequentially.

Table 4.17 Decision Matrix for Facilitator Recommendation

Rule Sequence	Condition 1: Availability	Condition 2: Skill	Condition 3: Minimum Experience	Output
R1	Busy/Leave	No	No	Exclude
R2	Yes	No	No	Reject
R3	Yes	Yes	No	Reject
R4	Yes	Yes	Yes	Accept

- Inference Engine Pseudocode

The following pseudocode represents the algorithmic structure implemented in the system backend. It demonstrates the Forward Chaining strategy where data is passed through the logic gates defined in the Decision Matrix.

```

ALGORITHM Generate_Recommendation
INPUT: Event_ID, Event_Category, Required_Skills, Min_Exp, Event_Date

START
    FETCH all Facilitators from Database
    INITIATE Recommended_List = []

    FOR EACH Facilitator IN Facilitators DO:

        // Step 1: Availability Check (Hard Constraint)
        IF (Facilitator has Assignment ON Event_Date) OR
            (Facilitator has Approved_Leave ON Event_Date) THEN
            CONTINUE to next Facilitator // Skip this person
        END IF

        // Step 2: Skill Competency Check (Knowledge Base)
        IF (Facilitator.Skills DOES NOT INCLUDE Required_Skills) THEN
            MARK status as "Unqualified"
            CONTINUE to next Facilitator
        END IF

        // Step 3: Safety/Experience Check (Heuristic Rule)
        IF (Facilitator.Experience < Min_Exp) THEN
            MARK status as "Safety Risk"
            CONTINUE to next Facilitator
        END IF

        // Step 4: Suitability Scoring (Ranking)
        CALCULATE Score = (Average_Rating * 0.7) + (Experience_Years * 0.3)
        ADD Facilitator to Recommended_List WITH Score

    END FOR

    // Step 5: Final Output
    SORT Recommended_List BY Score DESCENDING
    RETURN Recommended_List

END

```

Figure 4.8 Pseudocode of Rule-Based Logic Design

4.3 The Development of Workforce Management System

The development process of the Falcon Workforce Management System (FalconWFM) was based on the requirement analysis of functional requirements gathered during the early requirements phase. The system architecture was designed to support key modules such as event management, facilitator assignment utilizing an expert system, facilitator profile management, and peer feedback handling. A comprehensive methodology was adopted to convert use cases, user interface designs, and entity relationship models into functional components using PHP and MySQL technologies.

This workforce management system was built on a native PHP backend integrated with MySQL as the relational database management system using the Laravel framework. This system is developed on the Laravel 12 platform where it applied the PHP programming language. The frontend interface

was developed using standardized web technologies including HTML, Tailwind CSS, and JavaScript to ensure responsive and user-friendly interactions. Design specifications followed modern UI/UX principles, providing an intuitive experience across both desktop and mobile platforms. Controller and service logic in PHP were structured in a modular way to streamline data processing, session handling, and user validation. To ensure data integrity, consistency, and robustness in real-time assignments and facilitator data transactions, XAMPP was used as the local server environment which supports PHP and MySQL functionalities.

In terms of system design, modelling tools played important roles. Draw.io was used to produce visual documentation such as use case diagrams and domain class diagrams to provide simplicity in system behavior and logic. It was also used to produce the Entity Relationship Diagram (ERD) to map the interrelations between entities such as User, Facilitator, Event, Assignment, Attendance, and Performance Review. Although reporting was not a core focus in the domain model, a dashboard reporting feature was conceptualized and integrated as a UI-triggered data summary within the modules like Dashboard and Events, thus maintaining model simplicity while fulfilling stakeholder needs. Figma was used to design the user interface.

In this project, Visual Studio Code was the main development environment, applying the Laravel 12 framework which uses PHP and MySQL database for backend development.

4.3.1 The Development of Workforce Management System Features

The development of the workforce management system for FalconWFM involved transforming the user interface designs finalized during the user design phase into functional Laravel-based components. Each workflow was identified through the requirements gathering process and documented in the system use cases, which were carefully implemented into modular Laravel code. The system was designed to support all the key features required by both administrators and facilitators, including user registration, account login, event creation and management, automated facilitator assignment via expert rules, attendance tracking (Clock In/Out), peer feedback submission, and payroll processing. The generation of reports, where it generates a summary of facilitator performance and event status, was included as a key feature in this system.

This development phase was directly guided by the use cases derived from workforce optimization strategies. These strategies were embedded into the system architecture through features such as the

Rule-Based Expert System for smart assignments, real-time availability checks, and the peer-to-peer review module. This system ensures improved coordination between the management and its facilitators, which eventually boosts event success rates and ensures fair and optimal workforce allocation.

- The implementation code of manage event

This section demonstrates the core logic for the Event Management module. It handles the complete lifecycle of an event, starting with the strict validation of input data such as quotas and dates to ensure integrity. Once validated, the system securely commits the new or updated event details to the database, making them available for the matching process.

```
// Store new event
public function store(Request $request)
{
    $validated = $request->validate([
        'event_name' => 'required|string|max:255',
        'venue' => 'required|string|max:255',
        'event_description' => 'nullable|string',
        'event_category' => 'required|string',
        'required_skill_tag' => 'nullable|string',
        'quota' => 'required|integer|min:1',
        'start_date_time' => 'required|date',
        'end_date_time' => 'nullable|date|after:start_date_time',
    ]);

    Event::create($validated);

    return redirect()->route('events.index')->with('success', 'Event created successfully.');
}
public function update(Request $request, $id)
{
    $event = Event::findOrFail($id);

    $validated = $request->validate([
        'event_name' => 'required|string|max:255',
        'venue' => 'required|string|max:255',
        'event_description' => 'nullable|string',
        'event_category' => 'required|string',
        'quota' => 'required|integer|min:1',
        'start_date_time' => 'required|date',
        'end_date_time' => 'nullable|date|after:start_date_time',
    ]);

    $event->update($validated);
}
```

Figure 4.9 Implementation Code of Manage Event

- The implementation code of update profile

This snippet illustrates the Update Profile functionality, which allows facilitators to maintain their own portfolio. The system intelligently handles the synchronization of general user information with specific facilitator attributes such as banking details, experience levels, and skill sets to ensure that the facilitator's digital identity is always current and complete.

```
// Update Profile
public function update(Request $request)
{
    $user = Auth::user();
    $facilitator = $user->facilitator;

    $validated = $request->validate([
        'skills' => 'nullable|string',
        'experience' => 'nullable|string',
        'certifications' => 'nullable|string',
        'bank_name' => 'nullable|string',
        'bank_account_number' => 'nullable|string',
        'phone_number' => 'nullable|string',
        'join_date' => 'nullable|date',
    ]);

    if (!$facilitator) {
        $validated['user_id'] = $user->id;
        Facilitator::create($validated);
    } else {
        $facilitator->update($validated);
    }

    return redirect()->route('facilitator.dashboard')->with('success', 'Profile updated.');
}
```

Figure 4.10 Implementation Code of Update Profile

- The implementation code of rule-based expert system

This figure shows the Inference Engine which acts as the system's central intelligence to match facilitators with events. It automatically evaluates every facilitator against a specific event using a multi stage process that filters out unavailable candidates, compares skills against category rules, and finally ranks the remaining candidates by calculating a suitability score based on their experience and rating.

```

foreach ($facilitators as $facil) {
    $reason = null;
    $status = 'available';
    $debugReason = 'Qualified';

    if (!$this->checkAvailability($facil, $eventStart, $eventEnd, $reason)) {
        $status = 'busy';
        $debugReason = $reason;
    }
    $skillMatchScore = $this->calculateSkillMatch($facil, $rule, $event->requiredSkillTag ?? null);
    if ($status === 'available' && $skillMatchScore <= 0) {
        if ($rule && !empty($rule->requiredSkill)) {
            $status = 'unqualified';
            $reason = "No matching skills for {$category}";
            $debugReason = $reason;
        }
    }

    if ($status === 'available' && $rule && !$this->checkExperienceConstraint($facil, $rule, $reason)) {
        $status = 'unqualified';
        $debugReason = $reason;
    }
    $rating = $facil->averageRating ?? 0;
    $suitabilityScore = ($rating * 2) + $skillMatchScore;

    $results[] = [
        'id' => $facil->userID, // PK is userID
        'user_id' => $facil->userID,
        'name' => $facil->name,
        'email' => $facil->email, // Direct
        'match_score' => $suitabilityScore,
        'skills_matched' => $skillMatchScore,
        'rating' => $rating,
        'skills' => $facil->skills->pluck('skillName')->implode(', '),
        'experience' => $facil->experience,
        'join_date' => $facil->joinDate,
        'status' => $status,
        'reason' => $reason
    ];
}

```

Figure 4.11 Implementation Code of Rule-Based Expert System

- The implementation code of facilitator feedback

This section depicts the Performance and Reputation logic responsible for maintaining quality assurance. When an admin submits a review, the system captures the rating and feedback comments and then automatically triggers a recalculation of the facilitator's overall average rating. This ensures that a facilitator's reputation score is updated in real time, immediately affecting their ranking in future event recommendations.

```

public function store(Request $request, $facilitatorId)
{
    $request->validate([
        'rating' => 'required|integer|min:1|max:5',
        'feedback_comments' => 'nullable|string',
    ]);

    PerformanceReview::create([
        'facilitator_id' => $facilitatorId,
        'rating' => $request->rating,
        'feedback_comments' => $request->feedback_comments,
        'date_submitted' => now(),
    ]);

    // Update Average Rating
    $facilitator = Facilitator::findOrFail($facilitatorId);
    $avg = $facilitator->reviews()->avg('rating');
    $facilitator->update(['average_rating' => $avg]);

    return back()->with('success', 'Review submitted.');
}

```

Figure 4.12 Implementation Code of Facilitator Feedback

CHAPTER 5

CONCLUSION & RECOMMENDATION

This chapter provides a conclusion for the project, which focuses on the development of the Falcon Workforce Management System (FalconWFM) through the adoption of a rule-based expert system. It details the achievements related to all three project objectives, offers a comprehensive conclusion based on the work completed, and presents recommendations for future improvements. These suggestions aim to further enhance the project, ensuring users benefit from a more intelligent, scalable, and effective system.

5.1 Conclusion

In conclusion, the integration of a Rule-Based Expert System (RBES) within the FalconWFM development has successfully resolved critical operational issues related to facilitator assignment and performance monitoring. All three project objectives were successfully achieved.

The first objective, to identify system requirements based on workforce optimization strategies, was completed through the activities specified in the project methodology. By analyzing the decision-making criteria used by human administrators, the requirements for the expert system, such as availability checks, competency mapping, and risk-based experience constraints, were clearly defined. Stakeholder insights played a pivotal role in shaping system functionalities. The fundamental use cases identified included smart assignment via the inference engine, facilitator profile management, peer feedback submission, and attendance tracking. These requirements guided the construction of the Software Requirement Specification (SRS) document.

The second objective, to design the workforce management system, was achieved through the creation of the system design document. This included the architectural design, relational table, and

rule logic flowcharts. Additionally, user interfaces were designed for both the Admin Dashboard and Facilitator Portal using modern UI/UX principles. The design phase highlighted the importance of distinguishing between hard and soft constraints within the expert system logic to ensure recommendations were both accurate and practical. This modular design allowed the "Inference Engine" to function as an independent service, capable of updates without disrupting core event management features. This structure ensured data integrity, which is critical for the fairness of assignments and payroll calculations.

The third objective, to develop the FalconWFM system, was accomplished by implementing the system using selected technologies. The system was built using the Laravel 11 PHP framework, supported by MySQL as the back-end database. The development process adopted an object-oriented approach following the Model-View-Controller (MVC) architecture. The functional prototype was implemented in stages, with the Inference Engine serving as the central component to handle the forward-chaining logic for facilitator selection. The final system includes essential features such as event creation, automated candidate ranking, peer-to-peer reviews, and facilitator self-service profiles. Testing results indicate the system significantly improves the speed and accuracy of the assignment process compared to manual methods.

5.2 Limitation

Although the project was successful, several limitations were identified during the implementation and testing phases. The current version of the system primarily relies on hard-coded rules within the inference engine. While effective for defined scenarios, it lacks the ability to handle ambiguous or partial data effectively, a gap that concepts like Fuzzy Logic could address. Furthermore, the notification system is currently limited to web-based alerts and does not support real-time push notifications to mobile devices, potentially delaying facilitator responses to assignment offers. Additionally, the reporting module generates real-time data snapshots but lacks historical trend analysis or visualization tools to track workforce performance over long periods. Finally, the payroll calculation, while automated based on attendance, does not yet integrate with external banking APIs for direct disbursement.

5.3 Future Work

The Falcon Workforce Management System could be improved in several ways to increase its

functionality and market potential. The primary recommendation is the development of a native mobile application using frameworks like Flutter or React Native. This would enable real-time push notifications, GPS-based attendance verification (Geofencing) for clock-ins, and provide facilitators with easier access to the platform while on the go.

Additionally, the system would benefit significantly from enhancing the Rule-Based Expert System with Fuzzy Logic or Adaptive Inference capabilities. This advancement would allow the system to process degrees of truth (e.g., "Partial Availability" or "Strongly Matching Skills") rather than simple boolean logic, resulting in more nuanced and human-like assignment recommendations.

Furthermore, integrating a secure payment gateway such as Stripe or local bank APIs would support automated payouts. This feature would facilitate the instant, automated disbursement of allowances upon job completion verification, thereby increasing financial efficiency and trust. Finally, adding a predictive analytics module could provide valuable insights into peak demand periods. By predicting facilitator shortages and identifying skill gaps in the current workforce, the administration could implement data-driven recruitment strategies. These future improvements would align FalconWFM more closely with the evolving expectations of the gig economy and the event management industry.

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APPENDIX A : EXPERT SYSTEM ARCHITECTURE & FLOWCHART

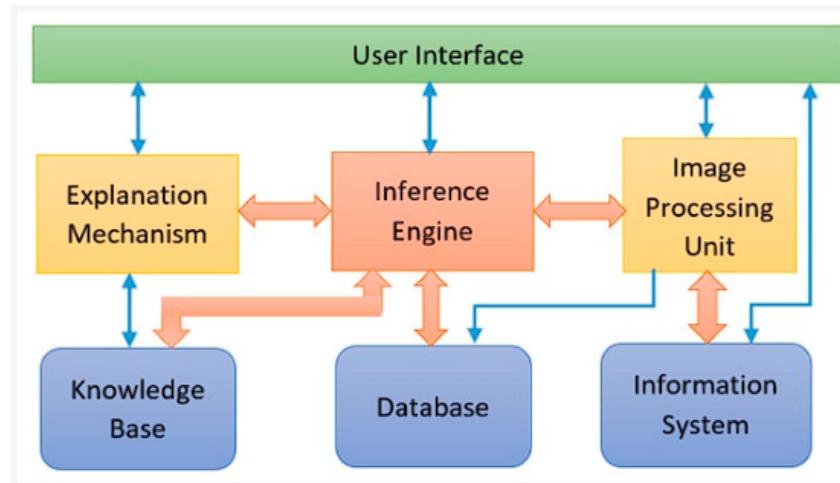


Figure A.1 Expert System Architecture (Hatzilygeroudis et. al,2023)

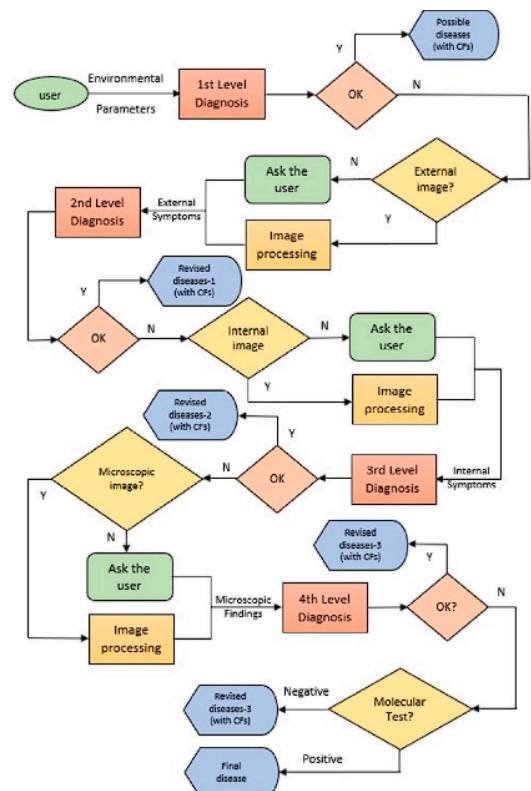


Figure A.2 Process Flowchart (Hatzilygeroudis et. al,2023)

APPENDIX B : Interview Session

This interview session was conducted physically. The participants in this session included Mr. Qawiem, operation manager from Falcon Kingdom Academy, and myself, Muhammad Amir Afham,

No	Question	Answer
1	Can you briefly explain the business that Falcon Kingdom Academy is doing?	Certainly. Falcon Kingdom Academy is a training and event consultancy under the MH Kingdom Empire. We specialize in conducting motivational events and training programs. This includes organizing team building sessions, workshops, camps, educational trips, and family programs. We rely heavily on team-based and hands-on experiences to deliver these programs. To run these operations, we currently manage a workforce of approximately 190 workers, which includes permanent staff as well as part-time and full-time facilitators.
2	How frequent an event is created in a month?	We handle a growing number of programs and facilitators. While the exact number varies by season, the frequency is high enough that our current manual processes for scheduling and tracking have become inefficient and error-prone. We have daily operational needs involving scheduling and workforce allocation.
3	What is your role or position in Falcon Kingdom Academy?	Right now, I act as the operation manager that handles the facilitators assignment in this company. Before this, I worked as a facilitator in this company.
4.	Can you explain the flow of the activity from creating events until the completion of the events?	The process starts with the Marketing Manager, who creates the event and blasts the details to social media to attract participants. Once the event is confirmed, the responsibility shifts to me as the Operation Manager. I start by assigning tasks to the committee, calculating the necessary costs and equipment, and arranging the event tentative. I then share the specific committee roles with the team. On the event day, the Facilitators take over the execution. They join the event, attend the venue, set up the equipment, and organize the activities. Once the event concludes, they handle the closing and clock out. After the event, the flow comes back to me to validate their attendance. I then spread the bank detail form to them. Finally, the facilitators fill in their bank details to process their allowance, which ends the cycle
5	Can you describe your main responsibilities in managing facilitators for events?	As the operation manager, my main responsibilities include assigning facilitators to events, managing their schedules, tracking attendance, and ensuring each event has the right number of facilitators based on the event requirements.
6	Who is responsible for creating the	The marketing manager is responsible for creating and

	events?	planning the events, including designing the program and promoting it to clients.
7	How is an event created?	The marketing manager will first discuss the event details with the client, prepare a program plan, and confirm it with management. Once the event is approved, the event information is shared with the operations department to begin facilitator assigning and logistics planning.
8	Is the operation manager involved in managing the events?	Yes, I am involved after the event is created. My role is to handle workforce planning, assigning facilitators, preparing logistics, and coordinating on-ground operations during the event
9	How do you currently validate attendance for facilitators?	Right now, facilitators send their live location through WhatsApp when they arrive and leave. We manually check the live location and confirm by referring to the payment form.
10	How do you monitor or evaluate facilitator performance after events?	I usually rely on feedback from facilitators, managers, personal observations, and cooperation during the event.
11	What information do you need when assigning facilitators to an event?	I need their experience, past involvement in similar programs, skills, behavior, availability, and sometimes their strengths or weaknesses reported by team leaders.
12	What kind of data or reports do you produce for management?	I prepare reports on attendance, number of facilitators involved, issues during the event, and sometimes performance summaries. Most of these are manually written and shared when requested.
13	What documents or tools do you currently use to manage this information?	We mainly use WhatsApp. Some information is also stored in chat or in paper files.
14	What kind of features would you expect from a Workforce Management System?	I would expect features for scheduling facilitators, attendance tracking, performance tracking, facilitator profiles, and a salary tracking would also be very helpful.
15	Would a facilitator recommender be useful for assigning them to such events?	Yes, absolutely. With a workforce of approximately 190 facilitators, it is becoming impossible for me to manually remember the specific skills, strengths, and past performance of every single individual
16	What problem do you personally face when you handle that many facilitators?	Currently, I often have to rely on assumptions or my own memory when assigning tasks, which unfortunately leads to frequent wrongly assigned roles. For example, I might assign someone to a technical role when their strength is actually in public speaking. A recommender system would solve this by objectively analyzing their profiles and past history to suggest the best match for each event, ensuring we have the right

		people in the right places without relying on guesswork.
17	What type of users should access this system?	Operation department staff, the marketing manager, facilitators.

APPENDIX C : Interview Session with Mr. Shafiq

Table of Question for Mr. Shafiq :

No	Question	Answer
1	Can you describe your role and responsibilities as a facilitator in Falcon Kingdom Academy events?	My job is to execute the programs on the ground. This includes attending the venue, setting up the necessary equipment, organizing the activities for participants, and ensuring the event runs smoothly until the closing ceremony.
2	What processes do you follow when you are assigned to a new event?	I wait for the tentative schedule. On the event day, I go to the venue, set up equipment, run the activities, and finally clock out and submit my bank details for payment processing.
3	How are you usually informed or selected to join an event?	Usually, the details are blasted on our main WhatsApp group. If I am selected, the Operation Manager assigns me to a specific committee group for that event.
4	How do you currently record or report your attendance during events?	Currently, we have to share our live location via WhatsApp when we arrive at the venue to prove we are there. We do the same when we leave to clock out.
5	How do you usually prepare before attending an event?	I review the tentative schedule shared inside the WhatsApp group and check what role I have been assigned, for example, logistics or speaker, so I can prepare the right mental state or equipment.
6	What steps do you take to confirm your participation in an event?	I usually reply in the WhatsApp group to confirm I am available and acknowledge the task assignment.
7	How do you currently submit your attendance or task completion?	Attendance is submitted using the WhatsApp live location feature. For task completion, I must fill in a bank detail form in the WhatsApp chat after the event is over.
8	How do you report any issues or feedback after the event?	We usually just discuss it when we meet each other or message each other in the group. There is no proper form or system to record feedback, so sometimes issues and feedback are usually forgotten.
9	From your experience, how could these operations be done more efficiently?	The most tiring part is filling in the bank details manually after every single event. It is repetitive. A system that saves my details would be much better. Also, there could be a better way to attend events, instead of constantly sharing live location when clocking in and filling in the clock in and clock out time.

10	What difficulties do you face when checking in or validating your attendance?	There are times when the line signal is bad due to the location, or I forget to share the location immediately. Also, since everyone shares locations in the group, the chat gets messy, and it is hard to trace back my specific attendance time.
11	Have you ever experienced confusion or delays in communication about event schedules?	Yes, definitely. The main delay is usually with salary payments. Because the bank details are collected manually using text, sometimes they get overlooked, and I receive my payment late.
12	What information do you receive before joining an event?	I receive the date, venue, and my assigned role.
13	What information do you wish you had access to when preparing for an event?	I wish I could see the full list of facilitators and their skills so we can coordinate better. I also want to see my past history to know which types of events I perform best in.
14	What outputs or reports do you produce after an event?	I only fill in the salary payment form in the Whatsapp group
15	What information would you like to view in the system?	I want to see my payment status, attendance record and my past event history records.

APPENDIX D : INTERVIEW TRANSCRIPT WITH MR.QAWIEM

Date: 25th November 2025

Location: Abang Topi Cool Station

Interviewer: Muhammad Amir Afham (Student)

Interviewee: Mr. Muhammad Qawiem Mustaqim (Operation Manager)

1. Amir: Can you briefly explain the business that Falcon Kingdom Academy is doing?

Mr. Qawiem: Falcon Kingdom Academy is a training and event consultancy. We specialize in training and motivational events such as team building, workshops, camps, educational trips, and family programs.

2. Amir: Thank you. Before we go into more detail, maybe we can start with a bit of background. Can you briefly explain the business that Falcon Kingdom Academy is doing?

Mr. Qawiem: Falcon Kingdom Academy is a training and event consultancy. We specialize in training and motivational events such as team building, workshops, camps, educational trips, and family programs.

3. Amir: That is a very impressive workforce size. With so many facilitators, how frequent an event is created in a month?

Mr. Qawiem: We have a growing number of programs. It varies, but we handle a wide variety of events regularly which requires a large workforce of around 190 facilitators.

4. Amir: Can you describe your main responsibilities in managing facilitators for events?

Mr. Qawiem: As the operation manager, my main responsibilities include assigning facilitators to events, managing their schedules, tracking attendance, and ensuring each event has the right number of facilitators based on the event requirements.

5. Amir: Who is responsible for creating the events?

Mr. Qawiem: The marketing manager is responsible for creating and planning the events, including designing the program and promoting it to clients.

6. Amir: How is an event created?

Mr. Qawiem: The marketing manager will first discuss the event details with the client, prepare a program plan, and confirm it with management. Once the event is approved, the event information is shared with the operations department to begin facilitator assigning and logistics planning.

7. Amir: Is the operation manager involved in managing the events?

Mr. Qawiem: Yes, I am involved after the event is created. My role is to handle workforce planning, assigning facilitators, preparing logistics, and coordinating on-ground operations during the event.

8. Amir: How do you currently validate attendance for facilitators?

Mr. Qawiem: Right now, facilitators send their live location through WhatsApp when they arrive and leave. We manually check the live location and confirm by referring to the payment form.

9. Amir: How do you monitor or evaluate facilitator performance after events?

Mr. Qawiem: I usually rely on feedback from facilitators, managers, personal observations, and cooperation during the event.

10. Amir: What information do you need when assigning facilitators to an event?

Mr. Qawiem: I need their experience, past involvement in similar programs, skills, behavior, availability, and sometimes their strengths or weaknesses reported by team leaders.

11. Amir: What kind of data or reports do you produce for management?

Mr. Qawiem: I prepare reports on attendance, number of facilitators involved, issues during the event, and sometimes performance summaries. Most of these are manually written and shared when requested.

12. Amir: What documents or tools do you currently use to manage this information?

Mr. Qawiem: We mainly use WhatsApp. Some information is also stored in chat or in paper files.

13. Amir: What kind of features would you expect from a Workforce Management System?

Mr. Qawiem: I would expect features for scheduling facilitators, attendance tracking, performance tracking, facilitator profiles, and salary tracking would also be very helpful.

14. Amir: What type of users should access this system?

Mr. Qawiem: Operation department staff, the marketing manager, and facilitators.

APPENDIX E: INTERVIEW TRANSCRIPT WITH MR.SHAFIQ

Date: 25th November 2025

Location: Abang Topi Cool Station

Interviewer: Muhammad Amir Afham (Student)

Interviewee: Mr. Muhammad Shafiq Shauqi (Facilitator)

1. Amir: Assalamualaikum and good afternoon, Mr. Shafiq. Thank you for taking the time to meet with me today. I am currently conducting requirement gathering for my Final Year Project to develop a Workforce Management System for Falcon Kingdom Academy. Your input as a facilitator is very important.

Mr. Shafiq: Waalaikumussalam, Amir. Good afternoon. No problem at all, I am happy to help with your project.

2. Amir: Thank you. Let's start with your background here. Can you describe your role and responsibilities as a facilitator in Falcon Kingdom Academy events?

Mr. Shafiq: My job is to execute the programs on the ground. This includes attending the venue, setting up the necessary equipment, organizing the activities for participants, and ensuring the event runs smoothly until the closing ceremony.

3. Amir: I see. What processes do you follow when you are assigned to a new event?

Mr. Shafiq: I wait for the tentative schedule. On the event day, I go to the venue, set up equipment, run the activities, and finally clock out and submit my bank details for payment processing.

4. Amir: Before you get to the venue, how are you usually informed or selected to join an event?

Mr. Shafiq: Usually, the details are blasted on our main WhatsApp group. If I am selected, the Operation Manager assigns me to a specific committee group for that event.

5. Amir: Once you are in that group, what information do you receive before joining an event?

Mr. Shafiq: I receive the date, venue, and my assigned role.

6. Amir: Is that information usually enough? What information do you wish you had access to when preparing for an event?

Mr. Shafiq: I wish I could see the full list of facilitators and their skills so we can coordinate better. I also want to see my past history to know which types of events I perform best in.

7. Amir: That makes sense for coordination. How do you usually prepare before attending an event?

Mr. Shafiq: I review the tentative schedule shared inside the Whatsapp group and check what role I have been assigned, for example, logistics or speaker, so I can prepare the right mental state or equipment.

8. Amir: And what steps do you take to confirm your participation in an event?

Mr. Shafiq: I usually reply in the WhatsApp group to confirm I am available and acknowledge the task assignment.

9. Amir: Moving on to the day of the event. How do you currently record or report your attendance during events?

Mr. Shafiq: Currently, we have to share our live location via WhatsApp when we arrive at the venue to prove we are there. We do the same when we leave to clock out.

10. Amir: Using live location sounds a bit dependent on internet connectivity. What difficulties do you face when checking in or validating your attendance?

Mr. Shafiq: There are times when the line signal is bad due to the location, or I forget to share the location immediately. Also, since everyone shares locations in the group, the chat gets messy, and it is hard to trace back my specific attendance time.

11. Amir: After the event concludes, how do you currently submit your attendance or task completion?

Mr. Shafiq: Attendance is submitted using the Whatsapp live location feature. For task completion, I must fill in a bank detail form in the WhatsApp chat after the event is over.

12. Amir: Aside from the bank details, what outputs or reports do you produce after an event?

Mr. Shafiq: I only fill in the salary payment form in the Whatsapp group.

13. Amir: Since this is all done manually via text, have you ever experienced confusion or delays in communication about event schedules?

Mr. Shafiq: Yes, definitely. The main delay is usually with salary payments. Because the bank details are collected manually using text, sometimes they get overlooked, and I receive my payment late.

14. Amir: Regarding the workflow, how do you report any issues or feedback after the event?

Mr. Shafiq: We usually just discuss it when we meet each other or message each other in the group.

There is no proper form or system to record feedback, so sometimes issues and feedback are usually forgotten.

15. Amir: Looking at the whole process, from your experience, how could these operations be done more efficiently?

Mr. Shafiq: The most tiring part is filling in the bank details manually after every single event. It is repetitive. A system that saves my details would be much better. Also, there could be a better way to attend events, instead of constantly sharing live location when clocking in and filling in the clock in and clock out time.

16. Amir: Finally, if we develop this new system, what information would you like to view in the system?

Mr. Shafiq: I want to see my payment status, attendance record and my past event history records.

17. Amir: That covers everything I needed. Thank you very much for your honest feedback, Mr. Shafiq.

Mr. Shafiq: You are welcome, Amir. Good luck with the project.

Software Requirements Specification

for

Workforce Management System using Rule-Based System

Version 1.0

Prepared by

MUHAMMAD AMIR AFHAM BIN SHAHRIZUAN, 2024542511

Table of Contents

Table of Contents	2
1. Introduction	1
1.1 Purpose	1
1.2 Document Conventions	1
1.3 Intended Audience and Reading Suggestions	2
1.4 Project Scope	3
2. Overall Description	4
2.1 Product Perspective	4
2.1.1 Product Features	6
2.2 User Classes and Characteristics	8
2.3 Operating Environment	9
2.4 Design and Implementation Constraints	10
2.5 Assumptions and Dependencies	12
3. System Features	13
Use Case Description 1	15
Use Case Description 3	18
Use Case Description 4	20
Use Case Description 5	23
Use Case Description 6	24
Use Case Description 7	25
Use Case Description 8	26
Use Case Description 9	28
Use Case Description 10	29
Use Case Description 11	30
Use Case Description 12	31
Use Case Description 13	33
Use Case Description 14	34
4. External Interface Requirements	35
4.1 User Interfaces	35
4.2 Hardware Interfaces	35
4.3 Software Interfaces	36
4.4 Communications Interfaces	36
5. Other Nonfunctional Requirements	37
5.1 Performance Requirements	37
5.2 Safety Requirements	37
5.3 Security Requirements	38
5.4 Software Quality Attributes	39
6. Other Requirements	41

- **Introduction**

- **Purpose**

The Software Requirements Specification (SRS) for the Falcon Kingdom Academy Workforce Management System outlines the architectural and functional requirements necessary to digitize the organization's operational workflows. The primary purpose of this system is to replace the current manual scheduling processes with a web-based solution. Key features detailed in this document include a Rule-Based Expert System for intelligent facilitator recommendations, automated availability conflict detection, and a centralized database for tracking facilitator skills, tenure, and performance ratings. This document serves as the definitive guide for developers and stakeholders to ensure efficient system development and implementation.

- **Document Conventions**

Convention	Description
Font size	The font size of 18 is used for the header, 14 for the sub header and 12 is used for writing content.
Font Type	The document uses Times New Roman for all text.
Bold	Headings and subheadings are formatted in bold to denote major sections and subsections.
Cross References	Cross-references to other sections are indicated using hyperlinks.
<i>Lists and Bullets</i>	Lists and bullet points are used to organize information clearly and concisely.
Appendices	<i>Additional information and supporting documents are included in the appendices at the end of the SRS.</i>
Abbreviations	SRS - System Requirements Specifications

Table 1.1 Document Conventions Description

- **Intended Audience and Reading Suggestions**

The organizational managers involved in the SRS document about the Falcon Kingdom Academy Workforce Management System are the developers, project managers, operation managers, and quality assurance testers. Developers will emphasize the aspects of the implementation of the core Rule-Based Inference Engine, the EventRule knowledge base, and assignment tracking functions. Project Managers will facilitate the shift of the manual WhatsApp system into the automated system, and all the specified rules must comply with the safety policies of the academy and the working schedules. The system will have direct interactions with users (who are the Operation Managers and Facilitators) to manage schedules and see job offers. The logic of the system will be checked by testers who will create extensive test cases to be sure that the inference engine accepts or rejects staff in accordance with the established criteria.

There are several important sections of the SRS document. The first is the Introduction, which gives the summary of the purpose of the document and the extent of the expert system. Second, the System Overview, which explains what restrictions the existing system of manual scheduling has and why the new rule-based automation is necessary. This is followed by the Functional Requirements which contains the logic behind the recommendation algorithms, knowledge base configuration and user interactions. The Non-Functional Requirements detail the performance requirements (recommendation speed), and reliability requirements. Finally, the System Interfaces describe the interaction between the application and the database along with the external user inputs, and then are logic decision matrices and diagrams in the form of appendices.

To have a good reading sequence, it is advisable to begin with the Introduction and System Overview in order to have an overall idea of why a rule based approach is being applied. Functional Requirements and Systems Interfaces should then receive priority among developers in so as to get the inference engine and database structure specific logic. Project Managers should consider both the operational and non-operational requirements so as to make the system achieve the targets of operational efficiency. The functional requirements should be read through by operation Managers and Facilitators who need to know their new workflow as well as by Testers so that they can read the logic constraints in the functional requirements to make the right test scenario.

- **Project Scope**

The proposed solution is the Falcon Kingdom Academy Workforce Management System aimed at automatizing and modernizing the staffing procedure of outdoor events replacing the currently used time-consuming manual coordination of this process organized through WhatsApp. The software makes use of a Rule-Based Expert System so that Operation Managers can enter the requirements of the events (e.g., "Water Safety," "High Intensity") and immediately get a list of available facilitators with an optimized result. The main characteristics are automated Inference Engine in which the staff is matched in terms of skills and tenure training and Knowledge Base where the definition of safety criteria is performed and a portal with a facilitator who is in charge of manageability in terms of making selections and getting assignments. The main idea of this software is to eradicate any conflict in the scheduling and that any event should be covered by qualified staff according to the goal of the organization to provide high safety and operational standards.

The ultimate goal of the system is to facilitate the overall business plan of professionalizing the resource management of the academy via use of technology to eliminate the bias and error made by humans in the selection process. These objectives also involve increasing the efficiency of the operations considerably by decreasing the duration of the search stages of the personnel, tolerance of the reliability of meeting the safety qualification regulations, and the satisfaction of the facilitators considering the acceptance of the assignment without bias. These additions will facilitate the logistics of the event planning process and enable the management team to put consideration on training and delivery to clients and not administration overhead.

- **Overall Description**

- **Product Perspective**

The Falcon Kingdom Academy Workforce Management System is a newly developed software solution designed to replace the organization's existing manual scheduling processes. While the academy has previously relied on decentralized communication tools (WhatsApp and Excel) to manage staffing, we are transforming this workflow into a centralized, intelligent web-based

platform. This system acts as a direct evolution of their operational management, refining the process by incorporating a Rule-Based Inference Engine to ensure efficiency, safety compliance, and scalability.

Context and Origin

The original method of workforce management was entirely manual, relying on Operation Managers to mentally recall facilitator qualifications and coordinate availability through chaotic WhatsApp group chats. This "legacy system" was prone to human error, double-booking, and bias in staff selection. The new Workforce Management System digitizes this entire workflow. It shifts the burden of decision-making from human memory to an automated Expert System, allowing managers to secure qualified staff for outdoor events without the administrative bottleneck.

New Features and Improvements

- Intelligent Recommendation Engine: unlike the manual selection process, the system automatically filters and ranks facilitators based on specific EventRules (e.g., matching "Water Safety" events only with staff who possess "Life Saving" skills and >2 years of experience).
- Automated Availability Management: Facilitators can now block out specific dates in advance using a "Leave" feature. The system strictly prevents these unavailable staff from appearing in recommendations, eliminating the risk of scheduling conflicts.
- Digital Tenure & Performance Tracking: The system automatically calculates a facilitator's experience level and tracks performance ratings after every event. This replaces static Excel sheets, ensuring that the "Knowledge Base" used for future recommendations is always dynamic and up-to-date.

Subsystem Interconnections

Subsystem interconnection refers to the internal communication between the new logic components introduced in the Workforce Management System:

Manager Interface and Inference Engine: The event creation interface captures the event details (Category, Date) from the manager and passes this data to the Inference Engine. The engine then triggers the recommendation algorithm to filter staff.

Inference Engine and Knowledge Base (EventRules): The engine queries the EventRule table to retrieve the specific qualification criteria (e.g., "Must have Swimming Skill") required for the selected event category before searching for candidates.

Facilitator Portal and Availability Module: The assignment response page captures the facilitator's "Accept" action. It immediately communicates with the Availability Module to "Lock" that specific date in the database, preventing the facilitator from being recommended for other overlapping events.

Feedback System and Scoring Database: The facilitator rating interface collects post-event performance scores (1-5 stars) from the manager. These scores are sent to the database to update the facilitator's Average Rating, which directly influences their ranking in future recommendations.

External Interconnections

Below are the interconnections between the Workforce Management System and external entities or data stores:

User Access (Web Portal): External users (Operation Managers and Facilitators) interact with the system via a web browser. The system authenticates their roles, granting Managers access to the Inference Engine and Facilitators access to the Job Assignment Dashboard.

Database: The system connects to a centralized MySQL database which acts as the persistent storage for the Knowledge Base (Rules), User Profiles (Skills/Tenure), and Operational Logs (Past Events). All subsystems retrieve and update data here to ensure real-time accuracy for the expert system.

• Product Features

The Falcon Kingdom Academy Workforce Management System has new features that will be applied to automate the process of staff allocation and remove scheduling mistakes that are done manually. These characteristics enable the management to utilize a Rule -Based Inference Engine to identify the most suitable candidates to conduct outdoor events and offer facilitators a

smooth portal to manage their working schedule. A high level description of the features is below:

Actor	Use Case	Use Case Description
Marketing Manager	Manage Event	Allows the Marketing Manager to create, update, delete, and view event details such as date, venue, and required skills.
	Login Account	Allows user to choose Facilitator, Operation Manager or Marketing Manager to log into system
Operation Manager	Manage Event	Views event details before assigning facilitators
	Assign Facilitator	The Operation Manager selects specific facilitators for an event, often utilizing the system's inference engine to find the best match.
	Manage Attendance	Handles the tracking of facilitator attendance clock in and clock out, then allows the Operation Manager to validate these records.
	Manage Leave	Update, Read and Delete facilitator's leave requests
	Manage Facilitator Account	Update and Delete facilitator account
	Login Account	Allows user to choose Facilitator, Operation Manager or Marketing Manager to log into system
	Manage Payroll	Facilitators submit their bank details, and the Operation Manager processes allowance payments based on validated attendance records.
Facilitator	Manage Event	Operation Manager and

		Facilitator can only read the event details.
	Update Profile	Facilitators can update their own profile by filling in their bank details, skills and experience
	Confirm Event Participation	Facilitators receive notifications for new job offers and can choose to either accept or decline the assignment.
	Submit Feedback Form	Facilitators can submit reports regarding issues or general feedback after an event to help improve future operations.
	View Past Event	Users can view a history of the events they have been involved in, including dates, roles, and attendance status.
	Login Account	Allows user to choose Facilitator, Operation Manager or Marketing Manager to log into system
	Apply Leave	Facilitator request leave
	Register Account	Create new facilitator account

- **User Classes and Characteristics**

In the Falcon Kingdom Academy system, the user base is divided into three distinct classes: Facilitators, Operation Managers, and Marketing Managers. Each class has specific permissions and interaction patterns tailored to their role in the event management lifecycle.

Characteristics	Facilitators	Operation Manager	Marketing Manager
Frequency of Use	Moderate /	High / Daily. Used	Periodic /

	Seasonal. Usage peaks during school holidays or camp seasons when job offers are frequent. They use it periodically to update availability or accept tasks.	continuously to plan upcoming events, run the recommendation engine, and validate attendance for ongoing programs.	Event-Based. Usage occurs primarily at the beginning of an event lifecycle when a new program is approved and needs to be entered into the system.
Functions Used	<ul style="list-style-type: none"> ● Confirm Event Participation ● Update Profile ● View Past Event History ● Apply for Leave 	<ul style="list-style-type: none"> ● Run Inference Engine (Recommend Suitable Facilitators) ● Assign Facilitators to Events ● Validate Attendance & Process Payroll 	<ul style="list-style-type: none"> ● Create New Events ● Update Event Details ● Delete Cancelled Events ● View Event Status
Technical Expertise	Basic to Moderate. Mostly comfortable with mobile apps and social media. They require a straightforward, intuitive interface.	Moderate. Proficient in office tools and logistics planning. They need to understand how to interpret the system's "Recommended List."	Moderate. Proficient in content management and digital marketing tools. They require an interface that allows for detailed data entry without errors.
Privilege	Standard (Self-Service). Restricted to accessing only their own profile, schedule, and payment history. Cannot view other staff's data.	High (Operational). Access to all facilitator profiles, sensitive attendance logs, and rating systems. Read/Write access to Assignment data.	Restricted (Event-Only). Strict access control limited to the Event Module. They cannot view facilitator bank details, payroll info, or operational performance ratings.
Educational Level	Varied. Typically consists of university students,	High. Typically senior staff or executives with	High. Typically holds a background in Business,

	fresh graduates, or freelance outdoor instructors.	experience in Human Resource management and logistics.	Marketing, or Communications.
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- **Operating Environment**

Qurban system is designed to operate in a variety of different hardware and software environments. To ensure the system has optimal performance, the following describes the hardware platform used, specifically the HP 15s-Eq3061AU (2022) used in using the system, but also considering broader compatibility for other users.

Hardware platform

Item	Description
HP 15s-Eq3061AU (2022)	Device
AMD Ryzen 5 5625U	Central Unit Processing
8 GB	Random Access Memory
512 GB SSD	Read-Only Memory
15.6 inch FHD	Display
Integrated AMD Radeon Graphics	Graphics
Wi-Fi 5, Bluetooth 5.0	Network

Operating System

Item	Description
Windows 11	Primary Operating System

Software Components

Item	Description
MySQL	Version 5.2.1 (up to date)
Visual Studio Code ver. 1.108.2	Version January 21 2026
Internet Browser	Google Chrome, Firefox, Internet Explorer

- Design and Implementation Constraints**

This section outlines the critical boundaries and limitations that govern the development of the Workforce Management System. These constraints, ranging from architectural decisions to operational compliance, define the scope of the project and ensure the final solution is both technically viable and operationally effective for Falcon Kingdom Academy.

1. Technological and Architectural Constraints

Database Management System (MySQL) The system is constrained to use MySQL as the primary relational database. This necessitates a rigid data schema design to support the Rule-Based Expert System. The database structure must be highly optimized to handle complex JOIN operations between the Facilitator profiles and the EventRule knowledge base. This ensures that data retrieval speed does not become a bottleneck during the inference process.

Development Framework and Integration The core web application is built using a PHP-based framework to ensure compatibility with standard web hosting environments. However, a key implementation constraint is the integration of the Inference Engine, which utilizes Python for logic processing. The system architecture must facilitate seamless communication between the PHP frontend and the backend logic. This requires the server environment to support shell execution functions to ensure the complex decision-making algorithms execute efficiently within the web server's limitations.

2. Hardware and Infrastructure Limitations

Server Computational Capacity Unlike standard data-entry systems, this project utilizes an Inference Engine that processes multiple logical conditions simultaneously, including Availability, Competency, and Safety checks. The server infrastructure is constrained by the

need for high computational efficiency. It must possess sufficient processing power to execute these filtering algorithms in real-time without causing latency or timeout errors for the user.

Device Diversity and Responsiveness The system design is heavily constrained by the diverse physical environments of its users. Operation Managers require a desktop-optimized interface for complex scheduling and data visualization. In contrast, Facilitators operate in outdoor field environments or camps, strictly limiting their access to mobile devices. Consequently, the system must strictly adhere to Responsive Web Design (RWD) principles to ensure full functionality on small touchscreens without sacrificing the complexity of data input.

3. Operational and Regulatory Constraints

Safety Compliance (The Expert System Logic) A unique constraint of this project is the non-negotiable nature of safety rules. The system is strictly bound by the hard constraints defined by the organization, such as the requirement for a minimum of 2 years of experience for High-Risk Camps. The implementation must be designed such that these specific rules are protected within the Knowledge Base. This prevents any user, regardless of privilege, from bypassing safety protocols during the assignment process.

4. Design Conventions and Maintainability

Standardized Coding Practices To ensure the system's longevity, the codebase must adhere to industry-standard coding conventions, such as the MVC Architecture. This is critical because the logical rules of the Expert System may evolve over time. The code structure must be modular and well-documented to allow future developers to update the Knowledge Base rules without risking the stability of the entire application.

- **Assumptions and Dependencies**

Assumption made that possibly affect the requirements is the internet connection available in the organization to be stable so the data changed can be seen by other users. It is also so that the notification can be sent to participants on-time.

Another assumption to be made is regarding the knowledge to use the software. The intended users for this system are assumed to know the technicality function of this system. Without prior knowledge of using this software, the intended users like participants can use the user manual as a guide to navigate throughout the system.

Next assumption would be the availability of the system for the users. The availability of the system actively functions during office hours so the interaction between participants and the staff of the organization can communicate efficiently.

Meanwhile, the dependencies of the system relies on the web database management like SQL for storing the data about packages that are offered to possible participants on the website. Other than that, relevant information like the order details made from participants and their own profile details are also stored inside the database management system.

Other dependency is that the system relies on web services such as chrome to operate the web-based system. The system is operated on a web browser to ensure a wide and broad user base that increase the possible participants that will join and partake in the Qurban act.

Another possible dependency is the system relies on hardware components that are compatible to open up a browser. Without a compatible device, it will be a difficult and uneasy experience for users to use the system itself. For example, low memory on RAM makes opening this system on other tabs hard.

- **System Features**

Use Case Diagram

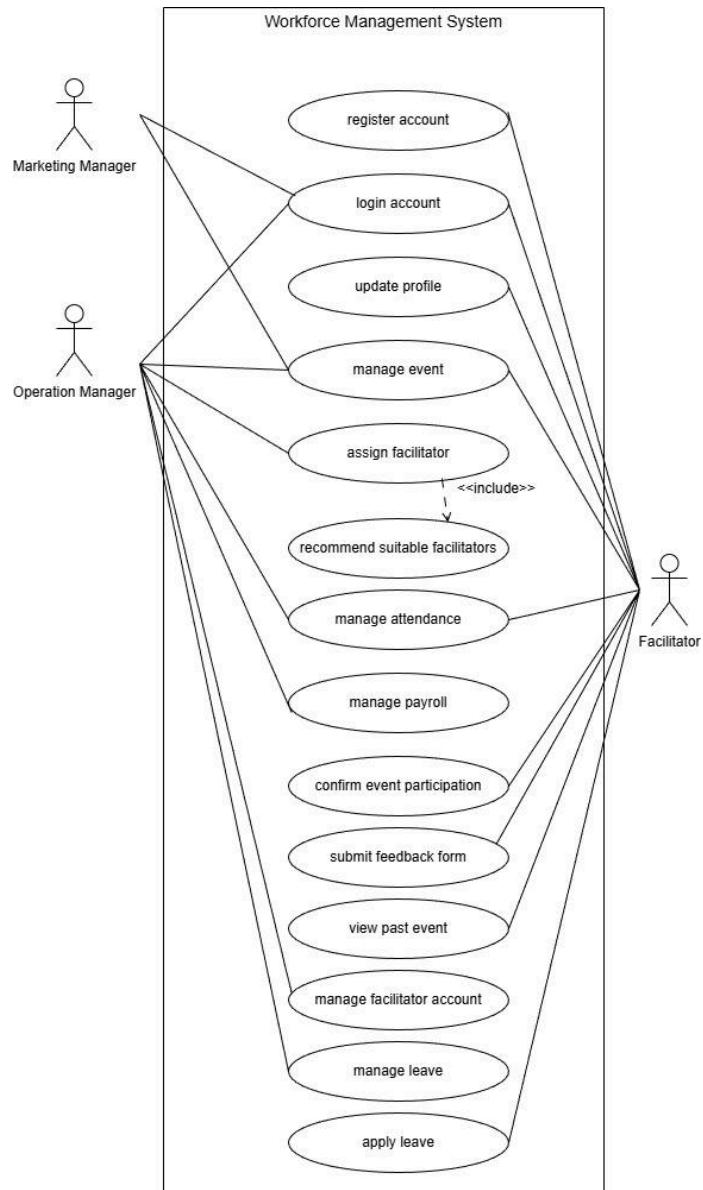


Figure 3.0 Use Case Diagram For Workforce Management System using Rule-Based System

Use Case Description 1

UCID	UC-100	
Use Case Name	Register Account	Created by: Amir Afham
Scenario	The facilitator registers a new account to access the system.	
Triggering Event	User clicks the “Register” hyperlink on the Login page	
Brief Description	The user enters personal details to create a new account.	
Actor	Facilitator	
Related Use Cases	- Not Applicable	
Stakeholders	Marketing Manager, Operation Manager, Facilitator	
Preconditions	<ol style="list-style-type: none"> 1. The user must not be logged in. 2. The user must start on the Login page 	
Post conditions	<ol style="list-style-type: none"> 3. A new facilitator is successfully created in the database. 4. A new facilitator appeared on the created event list 	
Flow of Activities	<i>Actor</i>	<i>System</i>
Normal flow/ Valid flow	1. Clicks “Register” link. 2. Enter Name, Email Address and Password. 3. Clicks “Create Account” button.	1.1. Display registration form [name, email address, password] 4. Verifies input information 5. Creates facilitator id 6. Saves facilitator information inside facilitator id in database. 7. Redirect to Login Page
Exception Conditions	E3: If the registration field is empty or the password is invalid, the system displays an error message and prompts the user to fill in the form. E4: If the email has been used, the system displays an error message and prompts the user to try another email.	

Special requirements / Business Rules	<ul style="list-style-type: none"> - Password must be at least 8 characters - Email must be unique - Email must have “@” and “.com”
Assumptions	<ul style="list-style-type: none"> - Not applicable -
Notes and issues	<ul style="list-style-type: none"> - Not applicable -

Use Case Description 2

UCID	UC-200	
Use Case Name	Login Account	Created by: Amir Afham
Scenario	The user logs in to the system to access the dashboard.	
Triggering Event	User opens the website	
Brief Description	Authenticates the user and grants access to marketing manager, operation manager and facilitator.	
Actor	Marketing Manager, Facilitator and Operation Manager	
Related Use Cases	- Not Applicable	
Stakeholders	Marketing Manager, Operation Manager, Facilitator	
Preconditions	1. The user must have a registered account	
Post conditions	1. The user have access to their own dashboard	
Flow of Activities	<i>Actor</i>	<i>System</i>

Normal flow/ Valid flow	3. Selects “Choose option” [Facilitator, Operation Manager, Marketing Manager] 4. Enters Email and Password 5. Clicks “Sign In” button	1. Displays Login page 2. Displays Login form 6. Verifies login credentials 7. Redirect to system dashboard
Exception Conditions	E4: If email or password do not match, System displays "Credentials do not match" error.	
Special requirements / Business Rules	<ul style="list-style-type: none"> - Password are hashed - Email must have “@” and “.com” 	
Assumptions	<ul style="list-style-type: none"> - Not applicable - 	
Notes and issues	<ul style="list-style-type: none"> - Not applicable - 	

Use Case Description 3

UCID	UC-300	
Use Case Name	Update Profile	Created by: Amir Afsham
Scenario	The user updates their own personal information and skills.	
Triggering Event	User clicks “Edit Profile”	
Brief Description	Allows users to keep their contact and professional details up to date.	
Actor	Facilitator	
Related Use Cases	<ul style="list-style-type: none"> - Not Applicable 	
Stakeholders	Operation Manager, Facilitator	
Preconditions	<ol style="list-style-type: none"> 1. The user must have been logged in. 2. The user profile must exists inside database 	

Post conditions	1. The user profile details are updated in the database	
Flow of Activities	<i>Actor</i>	<i>System</i>
Normal flow/ Valid flow	1. Clicks "Update Profile". 4.1 Clicks "Edit Profile" button 5.1 Enter facilitator form [full name, email, phone number, bank name, bank account number] 5.2 Click "Save Changes" button	1. Displays facilitator dashboard. 3. Displays facilitator profile 4. Displays "Edit Profile" button 5. Displays facilitator detail form [full name, email, phone number, bank name, bank account number] 6. Retrieve facilitator details 7. Verifies facilitator details 8. Send updated facilitator details to database 9. Display "Profile updated" success message
Exception Conditions	E6: If required fields are missing, the system prompts an error message.	
Special requirements / Business Rules	<ul style="list-style-type: none"> - Phone numbers must be valid numbers. - Bank account number must be valid. 	
Assumptions	<ul style="list-style-type: none"> - Not applicable - 	
Notes and issues	<ul style="list-style-type: none"> - Not applicable - 	

Use Case Description 4

UCID	UC-400	
Use Case Name	Manage Event	Created by: Amir Afham
Scenario	The user creates new events, updates events, deletes events, and views event details.	
Triggering Event	<ol style="list-style-type: none"> 1. The Marketing Manager receives request from clients to create event or training program 2. The Operation Manager want to see event details 3. The Facilitator want to see the event details 	
Brief Description	This use case describes the process of creating, updating, deleting and viewing event details in the system. Involves choosing event dates and venues.	
Actor	Marketing Manager, Facilitator and Operation Manager	
Related Use Cases	-	
Stakeholders	Marketing Manager, Operation Manager, Facilitator	
Preconditions	<ol style="list-style-type: none"> 1. The database has been created and is ready to be used. 2. The Marketing Manager must logged in to the system 3. The Marketing Manager must have 'Editor' privilege access the system 4. The Operation Manager and Facilitator can only read the events. 	
Post conditions	<ol style="list-style-type: none"> 1. A new event record is successfully created in the database 2. A new event appeared on the created event list 	
Flow of Activities	<i>Actor</i>	<i>System</i>
Normal flow/ Valid flow	All actors 1. Select "Events List" 2. Clicks on a specific event (Example : Kem Badar) to view details.	1.1 Displays lists of available events 2.1 Retrieve events details from database 2.2 Displays event details [Event Name, Venue, requiredSkillTags, status, quota, startDateTime, endDateTime, Facilitator Name List].

	<p>Marketing Manager</p> <p>4.1. Clicks “Create Event” button</p> <p>4.3. Displays event details form [Event Name, Venue, requiredSkillTags, status, quota, startTime, endTime, Facilitator Name List].</p> <p>4.4. Click “Create” button</p> <p>5. Clicks on a specific event to view details.</p> <p>6.1. Clicks “Edit” button</p> <p>6.3. Enters event information [Event Name, Venue, Total Participants, Required Skill Tag, Status, Quota, Start Date Time, End Date Time, Facilitator Name List]</p> <p>6.4. Clicks “Update”</p>	<p>3. Displays lists of available events</p> <p>4. Displays “Create Event” button</p> <p>4.2. Displays event details form [Event Name, Venue, requiredSkillTags, status, quota, startTime, endTime, Facilitator Name List].</p> <p>4.5. Retrieve event details.</p> <p>4.6. Verifies event information.</p> <p>4.7. Creates event in database</p> <p>4.8. Redirect to the event lists page.</p> <p>5.1. Retrieve events details from database</p> <p>5.2. Displays event details [Event Name, Venue, requiredSkillTags, status, quota, startTime, endTime, Facilitator Name List].</p> <p>6. Shows “Edit” event detail button</p> <p>6.2. Displays event details form [Event Name, Venue, requiredSkillTags, status, quota, startTime, endTime, Facilitator Name List].</p> <p>6.5. Retrieve event details.</p> <p>6.6. Verifies event information.</p> <p>6.7. Changes event information in database</p> <p>7. Redirect to the event detail page.</p>
Exception Conditions	E4.4: If the End Date is earlier than Start Date, the system shows error message “Start Date cannot be after End Date”	
Special requirements / Business Rules	<ul style="list-style-type: none"> - Marketing Manager can create many events, one event handled by one Marketing Manager - Facilitator can only view the event details - Operation Manager can only view the event details 	

Assumptions	- Not applicable -
Notes and issues	- Not applicable -

Use Case Description 5

UCID	UC-500	
Use Case Name	Assign Facilitator	Created by: Amir Afham
Scenario	The Operation Manager assigns and selects the suitable facilitator	
Triggering Event	An event is created	
Brief Description	The Operation Manager assigns facilitators to specific roles.	
Actor	Operation Manager	
Related Use Cases	UC-201 : Generate Recommendation	
Stakeholders	Operation Manager , Facilitator	
Preconditions	1. The event must exist 2. Facilitators must have registered to the system	
Post conditions	1. Facilitators are selected to an event	
Flow of Activities	<i>Actor</i>	<i>System</i>
Normal flow/ Valid flow	2. Clicks available event 5.1. Selects one or multiple facilitators 5.2. Click “Assign Facilitator” button 6.1 Clicks “Get Recommendation” button 7.1. Chooses facilitator for the event	1. Shows list of events available 3. Displays event details 4. Shows “Assign Facilitator” button 5. Shows list of facilitator names. 6. Shows “Get Recommendation” button 7. Shows recommended facilitator names. 8. Receives facilitator details 9. Verify facilitator information 10. Assign facilitator to an event ID 11. Saves facilitator assignment in database
Exception Conditions	E1: If the facilitator is already assigned to an event with a clash date, the system warns “Already Assigned to an event”.	
Special requirements / Business Rules	Facilitator is unable to be assigned to an event that overlaps with an existing assignment.	

Assumptions	- Not applicable -
Notes and issues	- Not applicable -

Use Case Description 6

UCID	UC-501	
Use Case Name	Recommend Suitable Facilitators	Created by: Amir Afham
Scenario	The system calculates the best facilitator match for an event.	
Triggering Event	Operation Manager clicks “Get Facilitators” button	
Brief Description	The system uses Content-Based Filtering to match event requirements with facilitator skills.	
Actor	Operation Manager	
Related Use Cases	UC-200 : Assign Facilitator	
Stakeholders	Operation Manager	
Preconditions	1. Facilitator with Skills 2. Event with Skill Tags	
Post conditions	1. A list of recommended facilitator is shown	
Flow of Activities	<i>Actor</i>	<i>System</i>
Normal flow/ Valid flow	1. Clicks “Recommend Suitable Facilitator” for an event	2. Analyze event category and requirements 3. Retrieve all Facilitator 4. Filters by Skills matched 5. Filters by Availability 6. Filters by Experience 7. Ranked by average rating 8. Displays list of “Recommended Facilitators”
Exception Conditions	E1 : If no facilitators are matched, system displays “No skill	

	matched facilitators are found”
Special requirements / Business Rules	- Not applicable -
Assumptions	- Not applicable -
Notes and issues	- Not applicable -

Use Case Description 7

UCID	UC-600	
Use Case Name	Manage Attendance	Created by: Amir Afham
Scenario	The facilitator records their clock in and clock out. Then, the Operation Manager validates it.	
Triggering Event	The facilitator arrives at the event venue	
Brief Description	Captures the Facilitator's attendance time and image	
Actor	Facilitator	
Related Use Cases	- Not applicable -	
Stakeholders	Facilitator, Operation Manager	
Preconditions	1. Facilitators have been assigned to an event 2. It is the event date 3. Facilitator must be	
Post conditions	1. Attendance record “Pending” will be created	
Flow of Activities	<i>Actor</i>	<i>System</i>
Normal flow/ Valid flow	Facilitator: 1. Click “Clock In” button 3. Capture image	2. Opens camera 4. Verifies facilitator information 5. Sends facilitator attendance to database

	Operation Manager: 6.1. Click facilitator attendance status 6.2. Change attendance status	6. Display list of facilitators attendances. 7. Verifies facilitator information 7.1. Sends updated facilitator attendance status to database 7.2. Shows attendance successfully updated message
Exception Conditions	E4 : Facilitator can only capture image on the same date as event	
Special requirements / Business Rules	<ul style="list-style-type: none"> - Image proof must be in JPG/PNG 	
Assumptions	<ul style="list-style-type: none"> - Not applicable - 	
Notes and issues	<ul style="list-style-type: none"> - Not applicable - 	

Use Case Description 8

UCID	UC-700	
Use Case name	Manage Payroll	Created by: Amir Afham
Scenario	Operation manager processes payment for completed work	
Triggering Event	Managing bank details and processing allowance claims.	
Brief Description	Tracking payment status and proofs.	
Actor	Operation Manager	
Related Use Cases	<ul style="list-style-type: none"> - Not applicable - 	
Stakeholders	Facilitator, Operation Manager	
Preconditions	1. Attendance must be validated	
Post conditions	1. Payment status updated to "Paid".	
Flow of Activities	<i>Actor</i>	<i>System</i>

Normal flow/ Valid flow	<p>1. Facilitator submits bank details in profile</p> <p>4. Operation Manager clicks "Payroll" for a specific events</p> <p>5. Clicks "Bank Details" on specific facilitator</p> <p>6. Clicks payment status from "Pending" to "Paid".</p> <p>6.2. Fills in proof of payment</p>	<p>2. Verifies facilitator information</p> <p>3. Saves bank information into the database.</p> <p>4.1. Shows list of payment statuses from facilitators</p> <p>4.2. Shows allowance request from facilitators.</p> <p>5.1. Shows facilitator bank information</p> <p>5.2. Shows payment status of facilitator. [Paid, Pending]</p> <p>6.1. Shows proof of payment input</p> <p>7. Verifies proof of payment</p> <p>8. Updates facilitator payment status in database</p>
Exception Conditions	E1: If the facilitator has not clocked out/verified attendance, the system shows "Attendance not verified. Cannot process payment."	
Special requirements / Business Rules	- Proof of payment only in JPG or PDF	
Assumptions	- Not applicable -	
Notes and issues	- Not applicable -	

Use Case Description 9

UCID	UC-800	
Use Case Name	Confirm Event Participation	Created by: Amir Afham
Scenario	Facilitator accepts the assignment that is assigned by the Operation Manager	
Triggering Event	The facilitator receives an assignment.	
Brief Description	Facilitator confirms their availability for the event	
Actor	Facilitator	
Related Use Cases	- Not applicable -	
Stakeholders	Facilitator	

Preconditions	1. Event must be created 2. Facilitator must be registered 3. Assignment status is “Pending”	
Post conditions	1. Assignment status becomes “Accepted” or “Rejected”	
Flow of Activities	<i>Actor</i>	<i>System</i>
Normal flow/ Valid flow	1.1. Clicks an event assignment request 2.[A1] 2.1. Click “Accept” button 3.[A2] 3.1. Click “Decline” button	1. Displays list of assignment request 1.2. Display event details.(eventName,eventStartDate,venue, eventEndDate) 1.3. Displays accept and reject buttons. [A1] : Accept Assignment [A2] : Decline Assignment 2.2. Verifies the data 2.3. Change the assignment status from “Pending” to “Confirmed” in the database 3.2. Verifies the data 3.3. Change the assignment status from “Pending” to “Declined” in the database
Exception Conditions	<ul style="list-style-type: none"> - E1: If response deadline exceeded, system disables action 	
Special requirements / Business Rules	<ul style="list-style-type: none"> - Facilitator unable to accept two events that occur at the exact same time - Facilitator must respond before the assignment offer expired. 	
Assumptions	<ul style="list-style-type: none"> - Not applicable - 	
Notes and issues	<ul style="list-style-type: none"> - Not applicable - 	

Use Case Description 10

UCID	UC-900	
Use Case Name	Submit Feedback Form	Created by: Amir Afham
Scenario	Facilitator provides performance rating to other facilitators and give comments	

Triggering Event	Facilitator completes an event	
Brief Description	Give rating out of 5 and textual comments	
Actor	Facilitator	
Related Use Cases	- Not applicable -	
Stakeholders	Facilitator, Operation Manager	
Preconditions	1. Facilitator must have attended the event.	
Post conditions	1. Feedback record is saved and linked to the Event ID.	
Flow of Activities	<i>Actor</i>	<i>System</i>
	1. Clocks out the attended event 3.1. Fill in feedback form 3.2. Click “Send” Button	2. Shows feedback form (facilitatorName, rating, comments). 3.3. Verify the data 3.4. Sends data to database 4. Recalculates average rating for facilitators
Exception Conditions	- Not applicable -	
Special requirements / Business Rules	- Rating must be in integer 1 to 5	
Assumptions	- Not applicable -	
Notes and issues	- Not applicable -	

Use Case Description 11

UCID	UC-1000	
Use Case Name	View Past Event	Created by: Amir Afham
Scenario	The facilitator reviews their work history	
Triggering Event	The facilitator wants to check past events.	

Brief Description	The facilitator views the history of the participating events.	
Actor	Facilitator	
Related Use Cases	- Not applicable -	
Stakeholders	Facilitator	
Preconditions	1. Facilitator must logged in to the system	
Post conditions	1. History of joined events displayed	
Flow of Activities	<i>Actor</i>	<i>System</i>
	1. Click “Past Event” button	2. Displays a table of past events [Event Name, Event Date, Event Venue, Total Participants, Average Rating].
Exception Conditions	- Not applicable-	
Special requirements / Business Rules	- Shows past event records from all time.	
Assumptions	- Not applicable -	
Notes and issues	- Not applicable -	

Use Case Description 12

UCID	UC-1100	
Use Case Name	Manage Facilitator Account	Created by : Amir Afham
Scenario	Operation Manager manages the pool of facilitators	
Triggering Event	Operation Manager want to create, update, view and delete facilitators	
Brief Description	The Operation Manager accesses the system to create a new facilitator, modify existing account details, or remove facilitators from the system.	
Actor	Operation Manager	
Related Use Cases	- Not applicable -	

Stakeholders	Operation Manager	
Preconditions	1. Logged in as Operation Manager	
Post conditions	1. New information of facilitator is saved in the system 2. New facilitator is created 3. Facilitator is removed	
Flow of Activities	<i>Actor</i>	<i>System</i>
Normal flow/ Valid flow	<p>Create</p> <p>2. Clicks “Add Facilitator” button 3. Fills in the form[full name, email address, password, specialization, experience, skills] 4. Clicks “Add Facilitator” button</p> <p>Update</p> <p>5. Clicks “Edit” button 6. Modifies the form[full name, email address, password, specialization, experience, skills] 7. Clicks “Update Facilitator” button</p> <p>Read</p> <p>8. Clicks “View” button</p> <p>Delete</p> <p>10. Clicks “Delete” button 12. Clicks “Confirm” button</p>	<p>1. Displays list of facilitators 2.1. Displays “Add New Facilitator” form [full name, email address, password, specialization, experience, skills] 4.1. Receives facilitator details 4.2. Validates facilitator details 4.3. Saves facilitator information inside database</p> <p>5.1. Displays “Edit Facilitator” form [full name, email address, password, specialization, experience, skills] 7.1. Receives facilitator details 7.2. Validates facilitator details 7.3. Saves facilitator information inside database.</p> <p>9. Displays Facilitator’s details[full name, email address, password, specialization, event assigned, experience, skills]</p> <p>11. Displays delete confirmation page 13. Delete facilitator in database</p>
Exception Conditions	E4.1 : Invalid data format	
Special requirements / Business Rules	<ul style="list-style-type: none"> - Password minimum 8 characters 	

Assumptions	- Not applicable -
Notes and issues	- Not applicable -

Use Case Description 13

UCID	UC-1200	
Use Case Name	Manage Leave	Created by : Amir Afham
Scenario	The operation manager processes leave request of facilitators	
Triggering Event	Facilitator apply for leave	
Brief Description	Approval and rejection of leave	
Actor	Operation Manager	
Related Use Cases	- Not applicable -	
Stakeholders	Facilitator, Operation Manager	
Preconditions	1. The facilitator must be registered 2. The leave request must exist	
Post conditions	1. Approved leave status 2. Rejected leave status 3. Deleted leave request	
Flow of Activities	<i>Actor</i>	<i>System</i>
Normal flow/ Valid flow	1. Clicks “Leave” button Update 3. Clicks “Update” button 5. Change new status [Approved , Rejected] 6. Clicks “Update Status” button Delete 10. Clicks “Delete” button 12. Clicks “Delete” button	2. Displays list of leave requests 4. Displays update leave status form. 7. Retrieve new leave request status. 8. Validates leave request status 9. Saves leave request status in the database. 11. Displays leave request delete confirmation popup 13. Removes leave request in the

		database.
Exception Conditions	- Not applicable -	
Special requirements / Business Rules	- Not applicable -	
Assumptions	- Not applicable -	
Notes and issues	- Not applicable -	

Use Case Description 14

UCID	UC-1300	
Use Case Name	Apply Leave	Created by : Amir Afham
Scenario	Facilitator request leave for personal or medical reason	
Triggering Event	Facilitator need time off from work	
Brief Description	Submitting a leave request	
Actor	Facilitator	
Related Use Cases	- Not applicable -	
Stakeholders	Facilitator, Operation Manager	
Preconditions	1. The facilitator must be logged in	
Post conditions	1. Pending leave request	
Flow of Activities	<i>Actor</i>	<i>System</i>

Normal flow/ Valid flow	<ol style="list-style-type: none"> 1. Clicks “Leave Request” button 3. Clicks “New Request” button 5. Fills in leave request form [Start Date, End Date, Reason] 6. Clicks “Submit Request” button 	<ol style="list-style-type: none"> 2. Display leave request dashboard 4. Displays leave request form [Start Date, End Date, Reason] 7. Retrieves leave request input 8. Validate leave request input 9. Creates a leave request in the database.
Exception Conditions	E4 : End leave date must be after start date	
Special requirements / Business Rules	<ul style="list-style-type: none"> - Leave must be applied at least 7 days in advance of the chosen leave date 	
Assumptions	<ul style="list-style-type: none"> - Not applicable - 	
Notes and issues	<ul style="list-style-type: none"> - Not applicable - 	

- **External Interface Requirements**

- **User Interfaces**

The Workforce Management System is accessible directly through a web browser via the localhost environment. The interface utilizes a clean design with standard forms, buttons, and tables to make navigation and data entry straightforward. To maintain system security and ensure that data remains protected, a login is required before any features or information can be accessed.

- **Hardware Interfaces**

The system interacts with two primary categories of hardware to support its dual-user nature. Desktop and laptop computers are essential for the Operation Department, utilizing

standard keyboards and mice to manage extensive administrative tasks such as maintaining the rule base and generating payroll reports within the localhost server environment. Simultaneously, smartphones and tablets are critical for the workforce, enabling facilitators to interact with the system via intuitive touchscreen interfaces to view job offers and submit attendance proofs from remote event venues. Connectivity for all devices is supported through Ethernet, Wi-Fi, or cellular networks (4G/5G), ensuring seamless access to the central system regardless of the user's location.

- **Software Interfaces**

The system operates within a standard local development environment, utilizing the Laravel 11 PHP Framework to orchestrate the interaction between the frontend and backend components. It relies on a MySQL 8.0 database for robust data management, storing critical entities such as facilitator profiles, event rules, and attendance logs, while PHP 8.2 or later handles the server-side scripting and "Inference Engine" logic. The application runs on a web server like Apache 2.4, which manages HTTP requests, and utilizes RESTful API services to exchange data in JSON format between the server and client-side interfaces, ensuring efficient synchronization for real-time tasks like quota updates and status changes.

- **Communications Interfaces**

Communication between the client browsers and the server is facilitated using standard HTTP protocols over TCP/IP, ensuring reliable data transmission for operations such as submitting event reports and retrieving real-time notifications. Although the current system operates in a localhost environment, the architecture supports the implementation of HTTPS for encrypted communication in future public deployments. Data interchange is standardized using the JSON format to ensure lightweight and fast performance, particularly for mobile users with varying internet speeds, while internal synchronization mechanisms instantly update the database to prevent conflicting assignments across concurrent users.

- **Other Nonfunctional Requirements**
- **Performance Requirements**

For operational efficiency, the Falcon Workforce Management System adheres to strict performance benchmarks to ensure timely facilitator deployment. The core "Inference Engine," which processes complex logic rules regarding availability, competency, and safety, is optimized to generate a "Recommended Suitable Facilitator" in under 3 seconds per request. This rapid processing ensures that Operation Managers can make real-time staffing decisions without system delay. Additionally, for standard interactions such as navigating dashboards or submitting feedback, the system is designed to respond to user inputs in less than 2 seconds to maintain a smooth and responsive user experience.

To support the academy's full workforce, the system is capable of handling over 200 concurrent users during peak operational windows, such as simultaneous event clock-ins, without experiencing timeouts. It is designed to ensure continuous, uninterrupted access during active event hours to guarantee that critical tasks like attendance tracking and safety reporting remain stable. Furthermore, critical alerts, specifically Job Assignment Offers, are delivered to facilitators' dashboards within 30 seconds of schedule confirmation, minimizing the latency between a vacancy opening and a facilitator accepting the role.

- **Safety Requirements**

To ensure the integrity and continuous operation of the Falcon Workforce Management System, a comprehensive safety strategy is implemented to protect against data loss, unauthorized access, and system failure. The primary safety requirement involves data preservation and recovery, specifically regarding facilitator attendance records and payment history. The system incorporates automated backup routines that create periodic snapshots of the MySQL database. These backups are stored securely on a separate storage medium to ensure that, in the event of a

catastrophic server failure or data corruption, the system can be restored to its last known stable state with minimal downtime.

Furthermore, the system is designed with fail-safe mechanisms to handle errors gracefully and prevent total application crashes. The Inference Engine includes specific exception handling to manage scenarios where input data is missing or invalid. Instead of terminating the process, the system logs the error and skips the problematic record, ensuring that remaining operations continue to function correctly. Finally, to safeguard sensitive personal information, strict Role-Based Access Control (RBAC) is enforced. Only authorized personnel, such as Operation Managers, are granted administrative privileges to modify critical data. Additionally, standard protocols like password hashing and session timeouts are implemented to prevent unauthorized access, thereby maintaining the trust and confidentiality of the workforce.

- **Security Requirements**

To ensure the security of the Falcon Workforce Management System and protect the sensitive information of its workforce, strict data protection policies are implemented. The system adheres to fundamental privacy standards by ensuring that all personal data, such as facilitator contact details and banking information, is processed with clear user consent and transparency. Access to this sensitive information is strictly regulated through Role-Based Access Control (RBAC), which ensures that only authorized Operation Managers can view or modify critical records, while facilitators are restricted to accessing only their own profiles. Furthermore, technical safeguards such as password hashing and secure session management are employed to prevent unauthorized entry and protect against common web vulnerabilities. These measures not only ensure compliance with ethical data management practices but also foster trust among the workforce by guaranteeing that their personal information remains confidential and secure from misuse.

- **Software Quality Attributes**

Adaptability

The system is designed to accommodate new user needs and emerging technologies without requiring a complete redesign. This capability is verified by assessing the effort required to incorporate new features while maintaining overall system stability.

Availability

The Falcon Workforce Management System is designed to operate on a continuous 24/7 basis to support critical workflows, including facilitator self-service for job acceptance and real-time oversight by Operation Managers. To ensure this high level of accessibility, the system is architected to prioritize stability and minimize downtime, ensuring that all stakeholders can access the system at any time. This continuous availability is essential for managing schedules, reviewing performance metrics, and handling event logistics without disruption, even outside of standard business hours.

Correctness

Operational accuracy is critical, with a target error rate of less than 0.1% for all transaction processing. This attribute is rigorously verified through periodic unit, integration, and acceptance testing to ensure all functions perform exactly as intended.

Flexibility

The system maintains high performance even when handling various configuration parameters. It is capable of managing at least twenty distinct settings without degradation, a capability confirmed through performance testing under different operational scenarios.

Interoperability

The architecture supports seamless integration with external systems and Application Programming Interfaces (APIs). The system is designed to interface effectively with at least five external platforms, ensuring smooth data exchange and communication.

Maintainability

Support and modifications are streamlined to ensure defects can be resolved quickly. The system targets an average resolution time of no more than 48 hours for fixing bugs, minimizing disruption to daily operations.

Portability

The system is built to function across diverse hardware and software environments with minimal configuration changes. Compatibility is tested across at least three different operating systems to ensure broad deployment flexibility.

Reusability

Components in the system should be relatable to other systems/projects such that at least 30% of the code modules used are from other systems/projects. Verification involves determining components that could be reused and records of these components and their application in other projects.

Robustness

The system is built to handle errors gracefully and recover from failures without data loss. Stress testing is conducted to ensure the system can withstand heavy loads and effectively execute recovery procedures when necessary.

Testability

The code structure allows for comprehensive testing, aiming for at least 90% code coverage. This high level of testability ensures that the vast majority of logic paths are validated to prevent hidden errors

Usability

The interface prioritizes intuitive design and easy navigation. This ensures that users, regardless of technical skill, can operate the system effectively immediately after implementation, reducing the learning curve.

- **Other Requirements**

The system utilizes MySQL as its core Relational Database Management System (RDBMS) to ensure organized and efficient data storage for the academy. A fundamental requirement of this design is the mandatory assignment of a Primary Key for every table within the database schema. This structure guarantees that every record, whether a facilitator profile or an event log, is uniquely identifiable. Consequently, this prevents data duplication and allows for the precise retrieval of specific information when needed.

To maintain the accuracy of the workforce data, the system strictly enforces referential integrity through the use of foreign key constraints. This mechanism preserves the logical relationships between different tables, such as ensuring every assigned job is securely linked to a valid facilitator. Additionally, the database defines specific data types for each attribute to ensure that only valid information formats are accepted. This proactive validation prevents errors and maintains the overall consistency of the system's records.

Finally, the database is designed with scalability in mind, capable of handling a continuously increasing volume of data without performance degradation. As historical attendance records and event logs accumulate, the system is optimized to execute queries efficiently on large datasets. This ensures that the application remains fast and responsive for Operation Managers, even as the database grows over time. By using proper indexing strategies, the system supports long-term growth while maintaining stability.

Appendix A: Glossary

Term	Definition
WFM	Workforce Management. The process of maximizing performance and competency for an organization, which this system automates.
RBES	Rule-Based Expert System. A system that uses a set of rules to solve problems or make decisions, used here for facilitator recommendations
RBAC	Role-Based Access Control. A method of restricting network access based on the roles of individual users within an enterprise.
MVC	Model-View-Controller. An architectural pattern used for developing user interfaces that divides an application into three interconnected parts
API	Application Programming Interface. A set of functions and procedures allowing the creation of applications that access the features or data of an operating system, application, or other service
JSON	JavaScript Object Notation. A lightweight data-interchange format used for data exchange between the server and web client.
SQL	Structured Query Language. A standard language for storing, manipulating and retrieving data in databases like MySQL
PHP	Hypertext Preprocessor. A widely-used open source general-purpose scripting language that is especially suited for web development.
UI	User Interface. The point of human-computer interaction and communication in a device, such as the dashboard or login screen.
HTTPS	Hypertext Transfer Protocol Secure. An extension of HTTP used for secure communication over a computer network.

Appendix B: Analysis Models

Domain Class Diagram

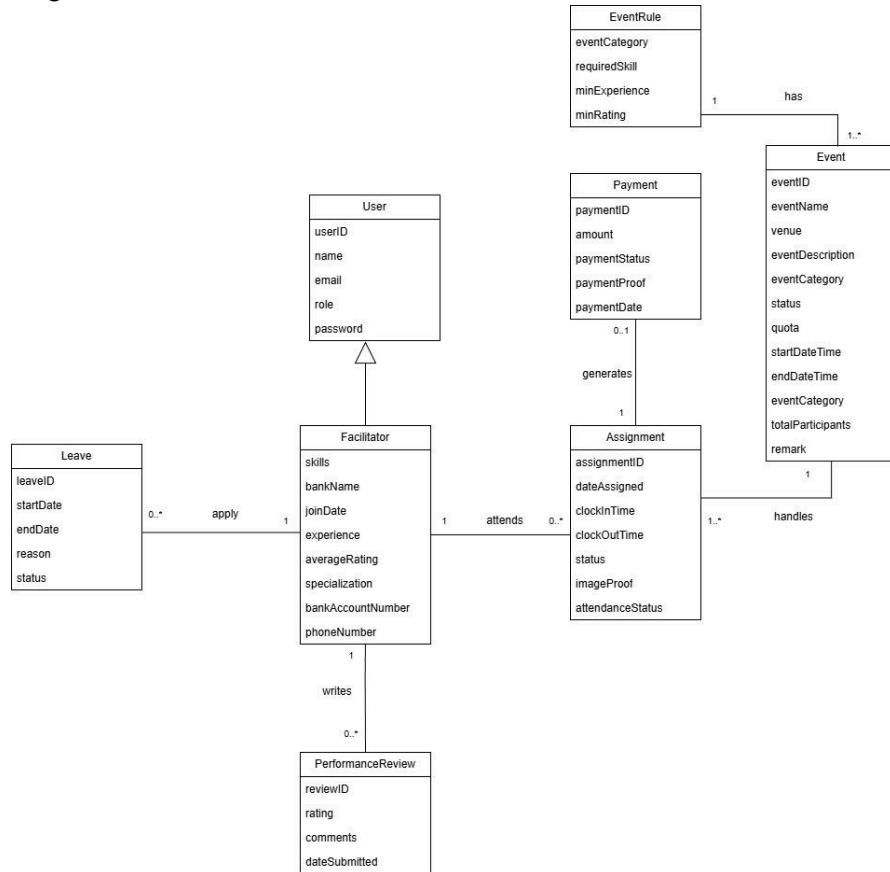


Figure 6.0: Domain Class Diagram

Activity diagram

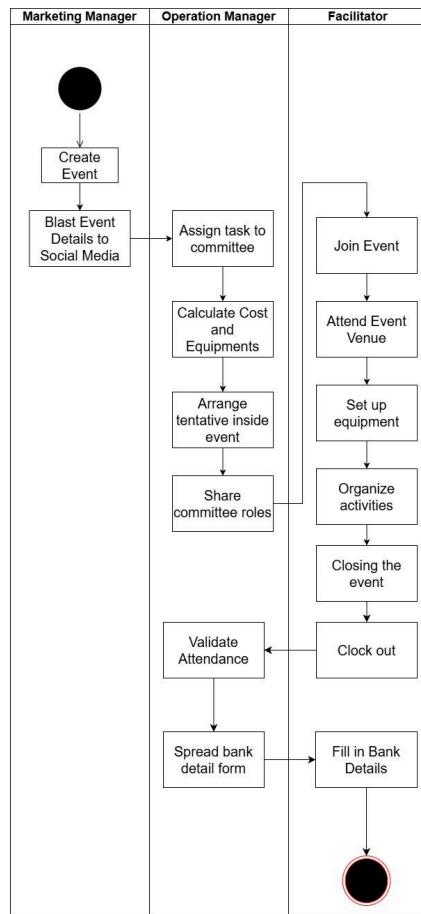


Figure 6.1 : Activity Diagram

Appendix C: Issues List

Not Applicable

Software System Design Document

Workforce Management System for Falcon Kingdom Academy using Rule-Based System

Group: CDCS2666B

Version: 1.0

Prepared By:

MUHAMMAD AMIR AFHAM BIN SHAHRIZUAN, 2024542511

Table of Contents

1. Introduction	3
1.1 Purpose	3
1.2 Scope	3
1.4 Document Structure	4
1.5 Definition, Acronyms, and Abbreviations	7
1.6 System Overview	8
2. System Architecture	10
2.1 Architectural Description	10
2.2 Design Rationale	11
2.3 Decomposition Description	12
3. Data Design	15
3.1 Database Description	15
3.2 Mapping of Problem Domain Classes to Relational Tables	15
3.3 Data Dictionary	16
4. Component Design	25
4.1 Package Identifier	25
4.1.2 Package Purpose	25
4.1.5 Package Function	26
4.1.4 Package Dependencies	27
5. Human Interface Design (Screens)	53
5.1 Overview of User Interface	53
5.2 Screen Images	54
5.3 Screen Objects and Actions	60
5.4 Report	60
6. Traceability Requirement Matrix	61
7. Resources Estimates	62
8. Appendices	63

1. Introduction

1.1 Purpose

The Software Design Documents (SDD) describes the system design and architecture of the Workforce Management System. The intended audience in this document are operation managers, marketing managers and facilitators. The main objective of the system is to digitize the manual scheduling process, allowing Operation Managers to optimize staff allocation using a Rule-Based Expert System while enabling Facilitators to manage their availability and assignments. This SDD focuses on explaining the system's core functionality and determining what data is required to process the entire workforce coordination and event staffing operation.

1.2 Scope

The Workforce Management System aims to modernize the manual staffing process and improve operational efficiency through a centralized web-based platform. The main system features include:

System functions:

- **Register account (SRS_UC_100):** Allows facilitators to register new accounts in the Workforce Management System.
- **Login account (SRS_UC_200):** Allows users to choose operation manager, marketing manager, and facilitators to log into the system.
- **Update Profile (SRS_UC_300):** Allows facilitators to update their own profile by filling in their bank details, skills, experience and specialization.
- **Manage Event (SRS_UC_400):** Enables marketing manager to create, update, delete, and view event details. The operation manager and facilitator can only read the event details.
- **Assign Facilitator (SRS_UC_500):** Allows the operation manager to select specific facilitators for an event.
- **Recommend Suitable Facilitators (SRS_UC_501):** Allows operation managers to use a Rule-Based Logic algorithm to suggest suitable facilitators based on their skills, experience, availability, and specialization.
- **Manage Attendance (SRS_UC_600):** Handles the tracking of facilitator attendance, then allows the Operation Manager to validate these records for payments.

- **Manage Payroll (SRS_UC_700):** Allows operation managers to process allowance payments based on validated attendance records.
- **Confirm Event Participation (SRS_UC_800):** Allows facilitators to receive new event job offers and can choose to either accept or decline the assignment.
- **Submit Feedback Form (SRS_UC_900):** Allows facilitators to submit feedback forms to comment on other facilitator's behaviour and give rating to other facilitators.
- **View Past Event (SRS_UC_1000):** Allows facilitators to view a history of the events they have been involved in.
- **Manage Facilitator Account (SRS_UC_1100):** Allows operation managers to create, update and delete facilitator accounts.
- **Manage Leave (SRS_UC_1200):** Enables the operation manager to update leave request status, view and delete facilitator's leave requests.
- **Apply Leave (SRS_UC_1300):** Allows the facilitators to make leave applications.

Benefits :

- Professionalizes resource management by upgrading manual methods to a technology driven standard.
- Eliminates human bias and error by selecting staff based on objective data rather than preference.
- Increases operational efficiency by reducing the time managers spend searching for candidates.

Objectives

- To automate the staffing procedure and replace manual coordination with a web based solution.
- To implement a Rule Based Expert System that instantly identifies qualified facilitators for events.
- To eradicate scheduling conflicts and ensure every event is covered by the right staff.

Goals

- Provide a user friendly interface that works for managers on desktops and facilitators on mobile devices.
- Centralize all facilitator skills and performance data into a single dynamic database.

- Ensure safety compliance by enforcing qualification rules strictly within the system logic.

1.3 Reference

Afham, A. (2025). *The Development of Workforce Management System using Rule-Based System* (Version 1.0)

Falcon Kingdom Academy. (n.d.). Home [Facebook page]. Facebook. Retrieved January 30, 2026, from <https://www.facebook.com/p/Falcon-Kingdom-Academy-100090643543011/>

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https://mygust.com/uploads/BOOK-Systems_analysis_and_design_in_a_changin.pdf

1.4 Document Structure

- 1.0: Introduction

This section sets the context of an SDD document that outlines purpose, scope, references, document structure, definitions, acronyms & abbreviations and system overview. The overview provides general information of the functionality, context and design of the project which make sure it's the certain context and what the system wants to deliver for its user.

- 2.0: System Architecture

System architecture breakdown into architectural description which explains the architecture used to design the system for the project and specify each specific core architectural component for its roles, function and purpose of each component. Next, design rationale describes the rationale of selecting the architecture that represents a general understanding of how and why the architecture of the system was decomposed and how individual parts work together. Lastly, decomposition description defines each

class problem domain and each controller has in the project refer to Package Diagram and Detail Class Diagram.

- 3.0: Data Design

Data design explains the database mapping structure from problem domain into relational and data dictionary for defining the data inside each of the tables inside the database. This section shows the version of the database that is being used and an overview of the attributes that each of the tables holds.

- 4.0: Component Design

This chapter is interested in elaborating on each of the components that make up the system. The document gives in-depth information on classes, packages, functions, dependencies, and interfaces that each of them possess. The explanation of each of the packages' objectives, features, dependencies, and component elements is in the section that titles it. The section of a package's class identifier gives in-depth information on specific classes, such as their interfaces, subordinates, dependencies, and use. The aim of this section is to make visible the system and structure of the organization in a manner that each of its components is developed in a careful manner to achieve desired outcomes.

- 5.0: Human Interface Design

The Human Interface Design section of a document is responsible for designing a system's user interface, its screens, objects, and actions. The section is composed of an overview of the user interface, screen images, screen objects and actions, and reports. The overview of the user interface presents a general picture of the system's interface and its interaction with the user. The screen images provide a graphical picture of each screen, its layout and components. The screen objects and actions describe objects and actions on each screen, and their interaction with the user. The section is employed to make a system's user interface easy to use, intuitive, and understandable, and to cater to the needs of the desired users.

- 6.0: Traceability Requirements Matrix

The Traceability Requirements Matrix section is a part of a document that provides details of the Traceability Requirements Matrix tool. The section discusses the application and role of the matrix, which traces the correlation between requirements and design components that execute requirements. The section is utilized to provide a transparent view of requirements transformed to design components and to check that requirements are always met in the course of development and testing. The Traceability Requirements Matrix section is a key tool to check a system's completeness and precision, and to manage requirements changes over time.

- 7.0: Resource Estimates

In this section all resources including hardware and software are used in succeeding the project. The resources all stated used in System Requirements, Development Environment, Local Development Server, Version Control and Integrated Development Environment (IDE).

- 8.0: Appendices

The appendices provide additional information to support SDD main content that hold all use case items including Model, View, Controller.

1.5 Definition, Acronyms, and Abbreviations

Term	Definition
View Layer	Presentation layer responsible for handling user interactions by displaying data that is processed from the controller.
Domain Layer	Represents business logic and rule of application. It processes data that is taken from user request and also handles for user response.
Model Layer	Representing the database by managing it such as retrieval, updating, insertion of data and it's a key part of the domain layer.
Detailed Class Diagram	A Detailed Class Diagram defines a whole relationship among all Model class, View class and Controller class. It also contains attributes, method between classes. It understands how data flows between objects.
Package Diagram	The diagram shows the overview how different modules interact in the application; it also includes Model, View, Controller (MVC). To simply put it is to understand how each component interacts and organises.

Acronyms

Acronyms	Description
WFM	Workforce Management
MVC	Model , View , Controller
PHP	Hypertext Preprocessor

2.0 System Overview

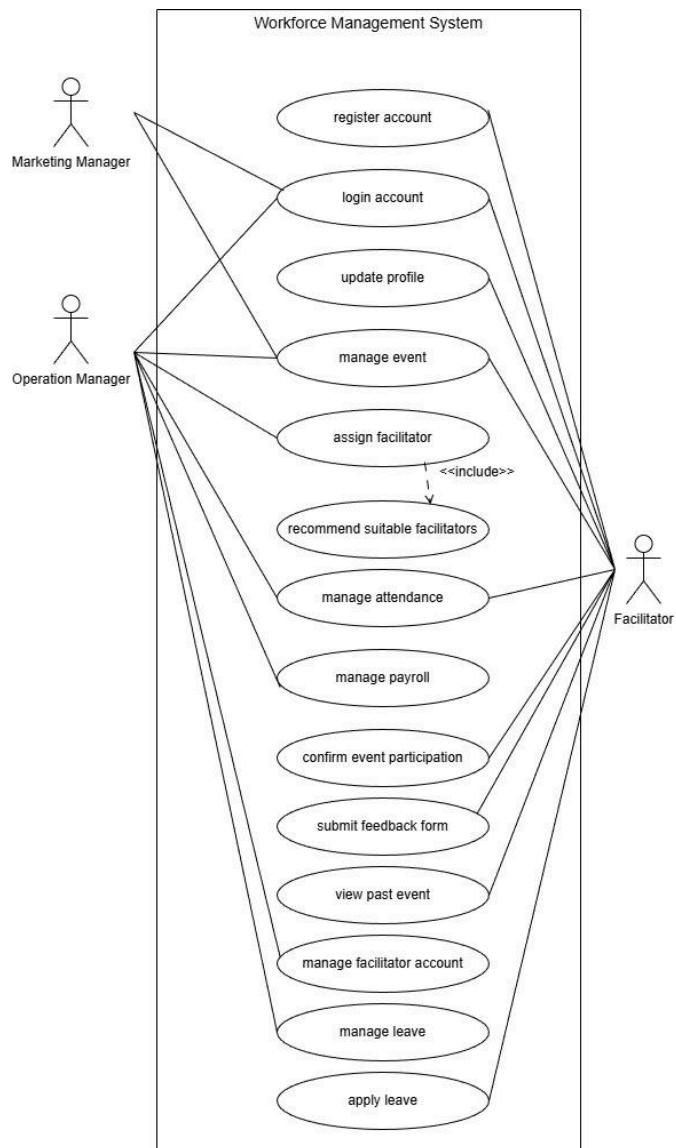


Figure 2.1 Use Case Diagram for Workforce Management System

Use Case description

UCID	Use Case	Description
UC-100	Register account	This use case allows facilitators to register new accounts in the Workforce Management System.
UC-200	Login account	This use case allows users to choose operation manager, marketing manager, and facilitators to log into the system.
UC-300	Update Profile	This use case allows facilitators to update their own profile by filling in their bank details, skills, experience and specialization.
UC-400	Manage Event	This use case enables marketing manager to create, update, delete, and view event details. Operation manager and facilitator can only read the event details
UC-500	Assign Facilitator	This use case allows the operation manager to select specific facilitators for an event.
UC-501	Recommend Suitable Facilitators	This use case allows operation managers to use a Rule-Based Logic algorithm to suggest suitable facilitators based on their skills, experience, availability, and specialization.
UC-600	Manage Attendance	This use case handles the tracking of facilitator attendance, then allows the Operation Manager to validate these

		records for payments.
UC-700	Manage Payroll	This use case allows operation managers to process allowance payments based on validated attendance records.
UC-800	Confirm Event Participation	This use case allows facilitators to receive new event job offers and can choose to either accept or decline the assignment.
UC-900	Submit Feedback form	This use case allows facilitators to submit feedback forms to comment on other facilitator's behaviour and give rating to other facilitators.
UC-1000	View Past Event	This use case allows facilitators to view a history of the events they have been involved in.
UC-1100	Manage Facilitator Account	This use case allows facilitators to view a history of the events they have been involved in.
UC-1200	Manage Leave	This use case allows operation managers to create, update and delete facilitator accounts.
UC-1300	Apply Leave	This use case allows the facilitators to make leave applications.

2. System Architecture

2.1 Architectural Description

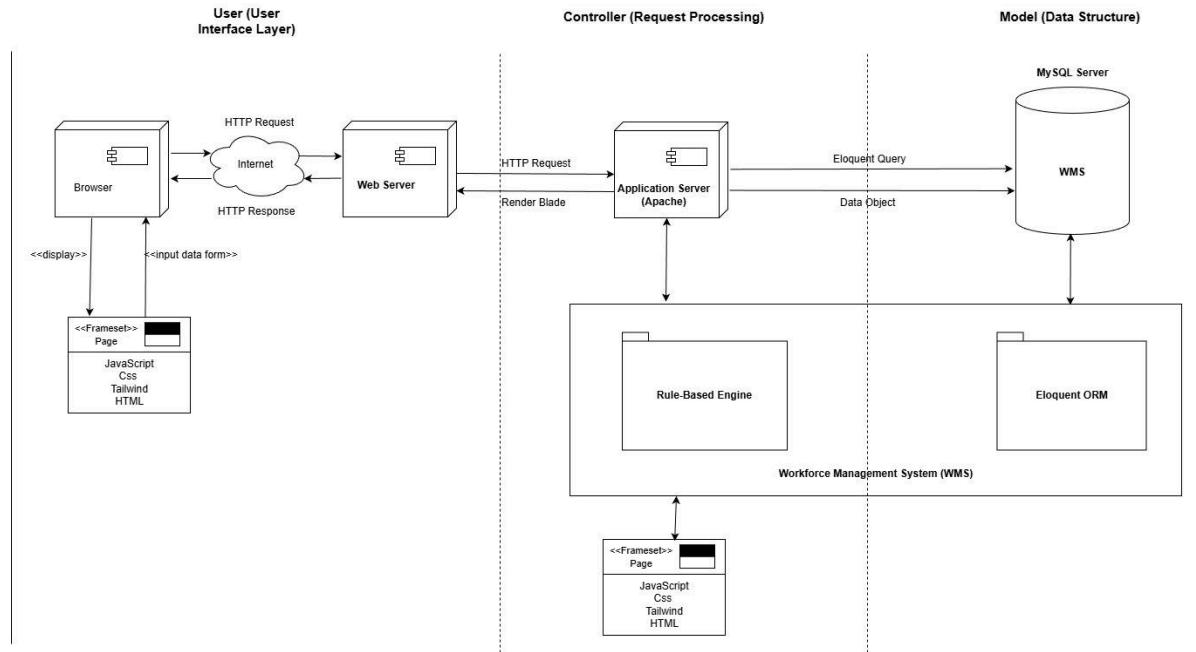


Figure 2.1 Architecture Diagram

The Falcon Workforce Management System is built upon the Model View Controller architectural pattern and utilizes the Laravel framework to ensure a modular and scalable development environment. This architecture enforces a strict separation of concerns by dividing the application into three interconnected components which are the Model, the View, and the Controller.

The Model represents the data structure and core business logic of the application. In this system, the Model interacts seamlessly with the database using the Eloquent Object Relational Mapping and Query Builder provided by Laravel. Each model class corresponds directly to a specific database table to facilitate efficient retrieval, insertion, updating, and deletion of records. Furthermore, the Model defines the intricate relationships between data entities such as one to one, one to many, and many to many associations to ensure data integrity and logical consistency throughout the application.

The View is responsible for the user interface and the presentation of data. Utilizing the Blade templating engine, the View renders dynamic content while requiring minimal syntax to keep

the frontend code clean and readable. This component strictly separates presentation logic from application logic as it does not process data but simply displays the information fetched and passed to it by the Controller. This separation ensures that the user interface remains distinct from the underlying business rules and makes the system easier to design and modify.

The Controller acts as the intermediary between the Model and the View by handling all incoming user requests. It orchestrates the flow of the application by receiving input from the View, validating the request, and processing the necessary business logic. Once the logic is processed, the Controller retrieves the required data from the Model and passes it back to the View for display. By organizing functions into separate controller classes, the system avoids code duplication and ensures a smooth and efficient data flow for tasks like submission handling and redirection.

2.2 Design Rationale

The choice to implement the Model View Controller architecture using Laravel framework version 11.36.1 is primarily driven by the need for a well structured development environment. This approach enforces a clear separation of concerns by dedicating the Model to database logic, the View to visual presentation, and the Controller to request management. Such distinct organization empowers developers to work on individual parts of the system independently which reduces dependency conflicts and streamlines the coding process.

Security remains a paramount priority in the design of this system and is significantly bolstered by the chosen architecture. The framework automatically includes essential defenses such as Cross Site Request Forgery protection to block malicious and unauthorized commands. It also enforces strict encryption standards to hide sensitive credentials like passwords from plain view in the database. Furthermore, the architecture inherently prevents SQL injection attacks by sanitizing database queries which ensures that unauthorized users cannot exploit vulnerabilities to access private workforce data.

The design also prioritizes scalability to ensure the application can handle increasing loads of traffic and data without performance degradation. By supporting both horizontal and vertical scaling, the system can manage concurrent requests from multiple operation managers and facilitators simultaneously. This scalability is matched by high maintainability as the separation of code into three distinct components allows for easier debugging and updates. Future

enhancements to the logic or interface can be deployed without risking the stability of the core application.

An alternative approach considered during the planning phase was the monolithic architecture where the entire application functions as a single unified unit. However, this model was rejected because its components are tightly coupled meaning that a change or error in one area often negatively impacts the rest of the system. Additionally, monolithic architectures typically rely on a singular database for all processes which frequently becomes a performance bottleneck during periods of high usage. Given the need for a responsive and flexible system for the academy, the modular MVC approach was determined to be the superior option.

2.3 Decomposition Description

The Falcon Kingdom Academy Workforce Management System is a specialized web based application developed to digitize manual staffing processes and optimize workforce allocation. The system streamlines critical operations such as event scheduling, facilitator profiling, attendance tracking, and intelligent staff selection. Designed using the Model View Controller architecture, the system is divided into three primary layers which are the View Layer, the Controller Layer, and the Model Layer, each with specific responsibilities and functional roles.

The View Layer acts as the primary interface between the user and the system. This layer enables Operation Managers to define event requirements and facilitates staff members in updating their availability or accepting job offers. The interfaces are designed with responsiveness in mind to ensure smooth interaction for managers on desktop devices and facilitators operating on mobile devices in the field.

The Controller Layer serves as the central processing hub of the system. It consists of several controller classes that handle user requests, validate inputs, and most importantly, execute the Inference Engine logic. Unlike standard applications, this layer integrates specific algorithms that filter facilitators based on safety rules and availability constraints before presenting recommendations to the manager. These controllers facilitate the complex operations of the system such as processing event assignments, validating clock in attempts, and calculating facilitator performance scores.

The Model Layer is responsible for managing the data structure and core business logic of the system. Each model is mapped directly to database tables such as Facilitators, Events, and Rules, and is tasked with executing business rules and facilitating Create Read Update and Delete operations. Data from the models is stored in a MySQL relational database which ensures that critical records like banking details and historical attendance logs are securely persisted and easily retrievable for payroll and reporting.

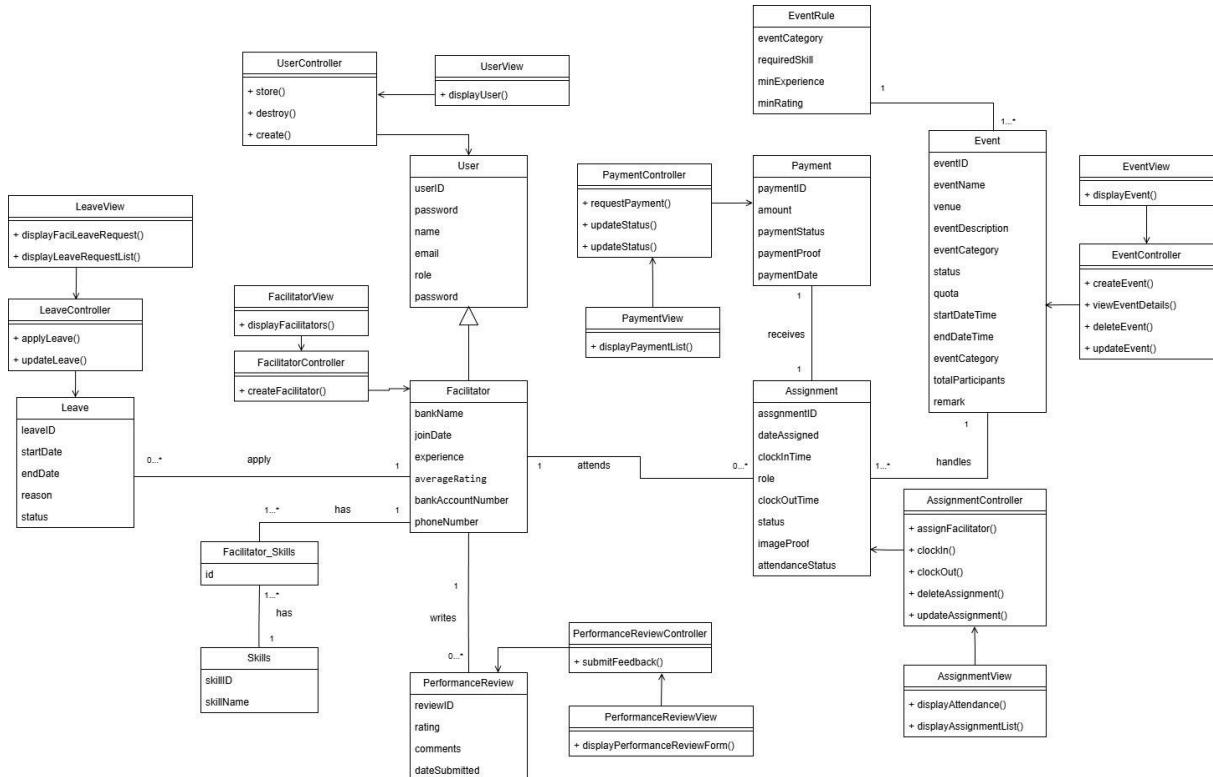


Figure 2.2 Detail Class Diagram

The Workforce Management System (WMS) is formed by nine classes of domains which cover the entire system, which are User, Leave, EventRule, Event, Assignment, Payments, Skills, Facilitator_Skills and PerformanceReview. The only many-to-many relationships in the domain are Facilitator, and Skills classes and the bridge class between them is Facilitator_Skills class. In addition, the Facilitator_Skills class would hold many

There are eight controller classes in total that act to hold distinct functions. The eight controller classes are RegisterController, ProfileController, LoginController, ManageOrderController, CartController, CheckoutController, NotificationController, ScheduleController and PackageController. The distinct functions mentioned to process each activity include retrieve data, display data, request handling data, business logic execution, validation data, error handling and managing redirections. Furthermore, these controllers are associated with multiple views and it allows controllers to request data and respond to data from views. Views or interfaces on the other hand will interact with the user while the user makes any action towards the system.

3. Data Design

3.1.1 Database Description

The database used and stored for the Workforce Management System is MariaDB through Xampp with MariaDB version 10.4.32. The reason for choosing MariaDB as our database is the efficient use of phpmyadmin which is one of the products of Xampp. The database that stores the data of the system consists of several key tables that hold different sets of services. The User table serves as the primary entity for storing authentication credentials and role definitions for all users. The Facilitator table contains additional profile information such as banking details and contact numbers. The Event table stores specific details regarding the organized events while the EventRule table specifies the necessary requirements for each category. The Assignment table links facilitators to events and records attendance status. The Leave table is used to store applications for time off. The Payment table manages the financial records linked to completed assignments. The Skills table and Facilitator_Skills table work together to manage the specific competencies of the staff. Lastly the PerformanceReview table stores the ratings and feedback for the facilitators.

3.2 Mapping of Problem Domain Classes to Relational Tables

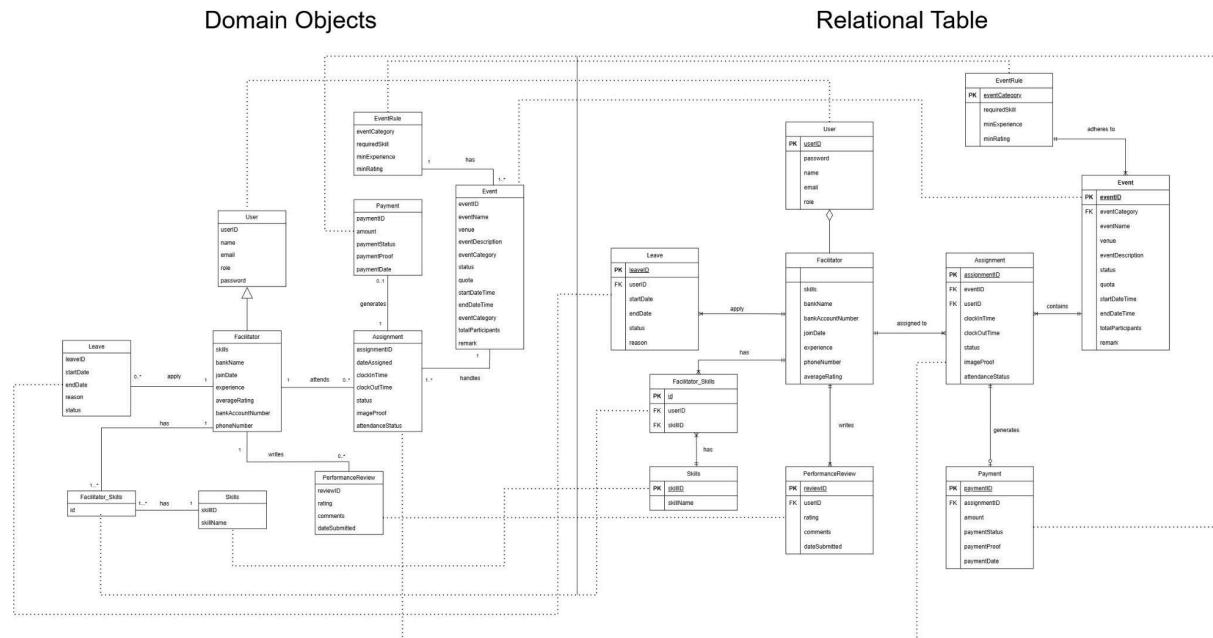


Figure 3.1 Mapping of Problem Domain Classes to Relational Tables

Mapping between a Domain Class Diagram (DCD) and a relational table involves translating the conceptual model of the domain into a detailed database schema. In a Domain Class Diagram, classes represent the entities within the domain, along with their attributes and relationships, which map directly to entities or tables in the relational table. For example, the Facilitator class in the DCD corresponds directly to a Facilitator entity in the relational table. Attributes in the DCD become columns in the relational table., and their data types are appropriately mapped to MySQL data types. In a one-to-many relationship, one User can have many Assignments. The relational table. shows this by connecting the Assignment table to the User table, demonstrating that one User can manage multiple assignments. This relationship is represented by a foreign key in the Assignment entity referencing the User.

3.3 Data Dictionary

Table Name : Users

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	userID	bigint(20)		UNSIGNED	No	None		AUTO_INCREMENT	Change Drop More
□ 2	name	varchar(255)	utf8mb4_unicode_ci		No	None			Change Drop More
□ 3	email	varchar(255)	utf8mb4_unicode_ci		No	None			Change Drop More
□ 4	email_verified_at	timestamp			Yes	NULL			Change Drop More
□ 5	password	varchar(255)	utf8mb4_unicode_ci		No	None			Change Drop More
□ 6	role	varchar(255)	utf8mb4_unicode_ci		No	user			Change Drop More
□ 7	bankName	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 8	bankAccountNumber	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 9	phoneNumber	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 10	experience	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 11	joinDate	date			Yes	NULL			Change Drop More
□ 12	averageRating	double			No	0			Change Drop More

Table Name : Assignment

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	assignmentID	bigint(20)		UNSIGNED	No	None		AUTO_INCREMENT	Change Drop More
□ 2	event_id	bigint(20)		UNSIGNED	No	None			Change Drop More
□ 3	user_id	bigint(20)		UNSIGNED	No	None			Change Drop More
□ 4	dateAssigned	datetime			No	current_timestamp()			Change Drop More
□ 5	clockInTime	datetime			Yes	NULL			Change Drop More
□ 6	clockOutTime	datetime			Yes	NULL			Change Drop More
□ 7	status	varchar(255)	utf8mb4_unicode_ci		No	assigned			Change Drop More
□ 8	attendanceStatus	varchar(255)	utf8mb4_unicode_ci		No	absent			Change Drop More
□ 9	imageProof	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More

Table Name : Leave

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	leaveID	bigint(20)		UNSIGNED	No	None		AUTO_INCREMENT	Change Drop More
□ 2	userID	bigint(20)		UNSIGNED	No	None			Change Drop More
□ 3	startDate	date			No	None			Change Drop More
□ 4	endDate	date			No	None			Change Drop More
□ 5	status	varchar(255)	utf8mb4_unicode_ci		No	pending			Change Drop More
□ 6	reason	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More

Table Name : Facilitator_Skills

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	id	bigint(20)		UNSIGNED	No	None		AUTO_INCREMENT	Change Drop More
□ 2	userID	bigint(20)		UNSIGNED	No	None			Change Drop More
□ 3	skillID	bigint(20)		UNSIGNED	No	None			Change Drop More

Table Name : Skills

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	skillID	bigint(20)		UNSIGNED	No	None		AUTO_INCREMENT	Change Drop More
□ 2	skillName	varchar(255)	utf8mb4_unicode_ci		No	None			Change Drop More

Table Name : PerformanceReview

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	reviewID	bigint(20)		UNSIGNED	No	None		AUTO_INCREMENT	Change Drop More
□ 2	userID	bigint(20)		UNSIGNED	No	None			Change Drop More
□ 3	rating	int(11)			No	None			Change Drop More
□ 4	comments	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 5	date_submitted	date			No	curdate()			Change Drop More

Table Name : Payment

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	paymentID	bigint(20)		UNSIGNED	No	None		AUTO_INCREMENT	Change Drop More
□ 2	assignmentID	bigint(20)		UNSIGNED	No	None			Change Drop More
□ 3	amount	decimal(10,2)			No	None			Change Drop More
□ 4	paymentStatus	varchar(255)	utf8mb4_unicode_ci		No	pending			Change Drop More
□ 5	paymentProof	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 6	paymentDate	date			Yes	NULL			Change Drop More

Table Name : Event

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
□ 1	eventID	bigint(20)		UNSIGNED	No	None		AUTO_INCREMENT	Change Drop More
□ 2	eventName	varchar(255)	utf8mb4_unicode_ci		No	None			Change Drop More
□ 3	venue	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 4	eventDescription	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 5	eventCategory	varchar(255)	utf8mb4_unicode_ci		Yes	NULL			Change Drop More
□ 6	status	varchar(255)	utf8mb4_unicode_ci		No	upcoming			Change Drop More
□ 7	quota	int(11)			No	0			Change Drop More
□ 8	startTime	datetime			No	None			Change Drop More
□ 9	endTime	datetime			Yes	NULL			Change Drop More
□ 10	totalParticipants	int(11)			No	0			Change Drop More
□ 11	remark	text	utf8mb4_unicode_ci		Yes	NULL			Change Drop More

Table Name : EventRule

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action	
□	1 eventCategory	varchar(255)	utf8mb4_unicode_ci		No	None			Change	Drop More
□	2 requiredSkill	text	utf8mb4_unicode_ci		Yes	NULL			Change	Drop More
□	3 minExperience	int(11)			No	0			Change	Drop More
□	4 minRating	int(11)			No	0			Change	Drop More

4. Component Design

4.1 Package Identifier

- An identifier unique throughout the SDD. Refer to section 2.3

User Management Package ID	Handle user registration, login, and profile update
SDD_CLASS_100	View Layer
SDD_CLASS_200	Controller Layer
SDD_CLASS_300	Model Layer

4.1.2 Package Purpose

A package diagram in the Unified Modeling Language is a high level diagram that allows the designer to group related classes into logical packages. In the context of the Workforce Management System, the project is organized into three distinct packages which are the View, the Controller, and the Model. Classes packaged together within the same namespace share similar purposes or functionalities. The classes in the View package are responsible for displaying the user interface to the user while the Controller package includes classes that manage core business logic and operational rules. The Model package consists of classes that handle interactions with the database to ensure data integrity and persistence.

4.1.5 Package Function

Package	Package Function
View Layer (SDD_CLASS_100)	<ol style="list-style-type: none">1. Display the form to accept the input from users and shows the output of the specific data2. Provide navigation for users to access different function through this system3. Notify users if any incorrect input data been detected or successful of the process
Domain Layer (SDD_CLASS_200)	<ol style="list-style-type: none">1. Process and validate data from users input on view layer into specific operations2. Execute the process and business rules for every domain class3. Serve as bridge for connection between the view layer and data access layer to ensure consistency.
Object Layer (SDD_CLASS_300)	<ol style="list-style-type: none">1. Manage and store data into database2. Receive all data that has been processed from domain layer3. Retrieve the selected data from database for users view4. Update or edit the existing data based on requirement5. Delete unnecessary data

4.1.4 Package Dependencies

Package dependencies define the necessary interactions between system components to ensure they function together as a cohesive unit. In this configuration the View package relies on the Controller to handle user inputs and supply the processed data required for the interface display. The Controller acts as the central intermediary that depends on the Model package to validate business rules and manage data storage or retrieval. Consequently the Model package underpins the entire operation by maintaining data integrity and serving the precise information requested by the Controller which ensures that the system executes every function correctly without direct dependencies between the interface and the database.

4.1.5 Package Component

Packages	Classes
View Layer	Login Register ViewFacilitatorProfile ViewUpdateProfile ViewManageEvent ViewAssignFacilitator ViewRecommendSuitableFacilitators ViewManageAttendance ViewManagePayroll ViewConfirmEventParticipation ViewSubmitFeedbackForm ViewPastEvent ViewManageFacilitatorAccount ViewManageLeave ViewApplyLeave
Controller Layer	AuthController FacilitatorController AttendanceController

	AssignmentController EventRuleController RuleBasedController EventController PerformanceReviewController SkillsController FacilitatorSkillsController
Model Layer	User Leave Facilitator_Skills Skills Payment PerformanceReview Event EventRule Assignment

4.1.5.1 Class Identifier

- An identifier unique throughout the SDD

Packages	Classes
View Layer (SDD_CLASS_100)	Register(SDD_CLASS_101) Login(SDD_CLASS_102) ViewFacilitatorProfile(SDD_CLASS_103) ViewUpdateProfile(SDD_CLASS_104) ViewManageEvent(SDD_CLASS_105) ViewAssignFacilitator(SDD_CLASS_1056) ViewRecommendSuitableFacilitators(SDD_CLASS_107) ViewManageAttendance(SDD_CLASS_108) ViewManagePayroll(SDD_CLASS_109) ViewConfirmEventParticipation(SDD_CLASS_110) ViewSubmitFeedbackForm (SDD_CLASS_111) ViewPastEvent(SDD_CLASS_112) ViewManageFacilitatorAccount(SDD_CLASS_113) ViewManageLeave(SDD_CLASS_114) ViewApplyLeave(SDD_CLASS_115)
Controller Layer (SDD_CLASS_200)	AuthController (SDD_CLASS_201) FacilitatorController (SDD_CLASS_202) AttendanceController (SDD_CLASS_203) AssignmentController (SDD_CLASS_204) EventRuleController (SDD_CLASS_204) RuleBasedController (SDD_CLASS_205) EventController (SDD_CLASS_206) PerformanceReviewController (SDD_CLASS_207) SkillsController (SDD_CLASS_208) FacilitatorSkillsController (SDD_CLASS_209) PaymentController (SDD_CLASS_210) LeaveController (SDD_CLASS_211)

Model Layer (SDD_CLASS_300)	User (SDD_CLASS_301) Leave (SDD_CLASS_302) Facilitator_Skills (SDD_CLASS_303) Skills (SDD_CLASS_304) Payment (SDD_CLASS_305) PerformanceReview (SDD_CLASS_306) Event (SDD_CLASS_307) EventRule (SDD_CLASS_308) Assignment (SDD_CLASS_309)
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4.1.5.2 Class Dependencies

The Design Class Diagram describes the relationships between classes, whether within the same package or across different packages. The relationships between classes in the controller and those in the model, as well as the dependencies between classes in the view and those in the controller, are illustrated in this diagram. This diagram helps to illustrate how classes in various layers depend on one another to work properly

4.1.5.3 Interfaces

The control and data flow from one class to another can be seen in the Design Class Diagram in Section 2, Decomposition Description 2.3.

4.1.5.4 Data

All data that is being used can be referred to in the Data Dictionary in Section 3, Data Dictionary 3.3

5. Traceability Requirement Matrix

Requirement Use Case ID	Packages	View Layer										Controller Layer					Model Layer																			
		(SDD_CLASS_100)										(SDD_CLASS_200)					(SDD_CLASS_300)																			
	Classes		SDD_CLASS_101	SDD_CLASS_102	SDD_CLASS_103	SDD_CLASS_104	SDD_CLASS_105	SDD_CLASS_106	SDD_CLASS_107	SDD_CLASS_108	SDD_CLASS_109	SDD_CLASS_110	SDD_CLASS_111	SDD_CLASS_112	SDD_CLASS_113	SDD_CLASS_114	SDD_CLASS_115	SDD_CLASS_201	SDD_CLASS_202	SDD_CLASS_203	SDD_CLASS_204	SDD_CLASS_205	SDD_CLASS_206	SDD_CLASS_207	SDD_CLASS_208	SDD_CLASS_209	SDD_CLASS_210	SDD_CLASS_211	SDD_CLASS_301	SDD_CLASS_302	SDD_CLASS_303	SDD_CLASS_304	SDD_CLASS_305	SDD_CLASS_306	SDD_CLASS_307	SDD_CLASS_308
UC-100 (Register Account)	/																																			
UC-200 (Login Account)	/																																			
UC-300 (Update Profile)		/	/																																	
UC-400 (Manage Event)				/																																
UC-500 (Assign Facilitator)					/																															
UC-501 (Recommend Suitable Facilitator)						/																														
UC-600 (Manage Attendance)							/																													
UC-700 (Manage Payroll)								/																												
UC-800 (Confirm Event Participation)									/																											
UC-900 (Submit FeedbackForm)										/																										
UC-1000(View Past Event)											/																									
UC-1100 (Manage Facilitator Account)												/																								
UC-1200 (Manage Leave)													/																							
UC-1300 (Apply Leave)														/																						

Figure 6.0.1 Traceability Requirement Matrix chart

Figure 6.0.1 shows the system **Traceability Requirement Matrix** of Workforce Management System. In this chart it contains all use cases that correspond to Class and Package available which can be referred to at 4.1.

6. Appendices

Relational Table

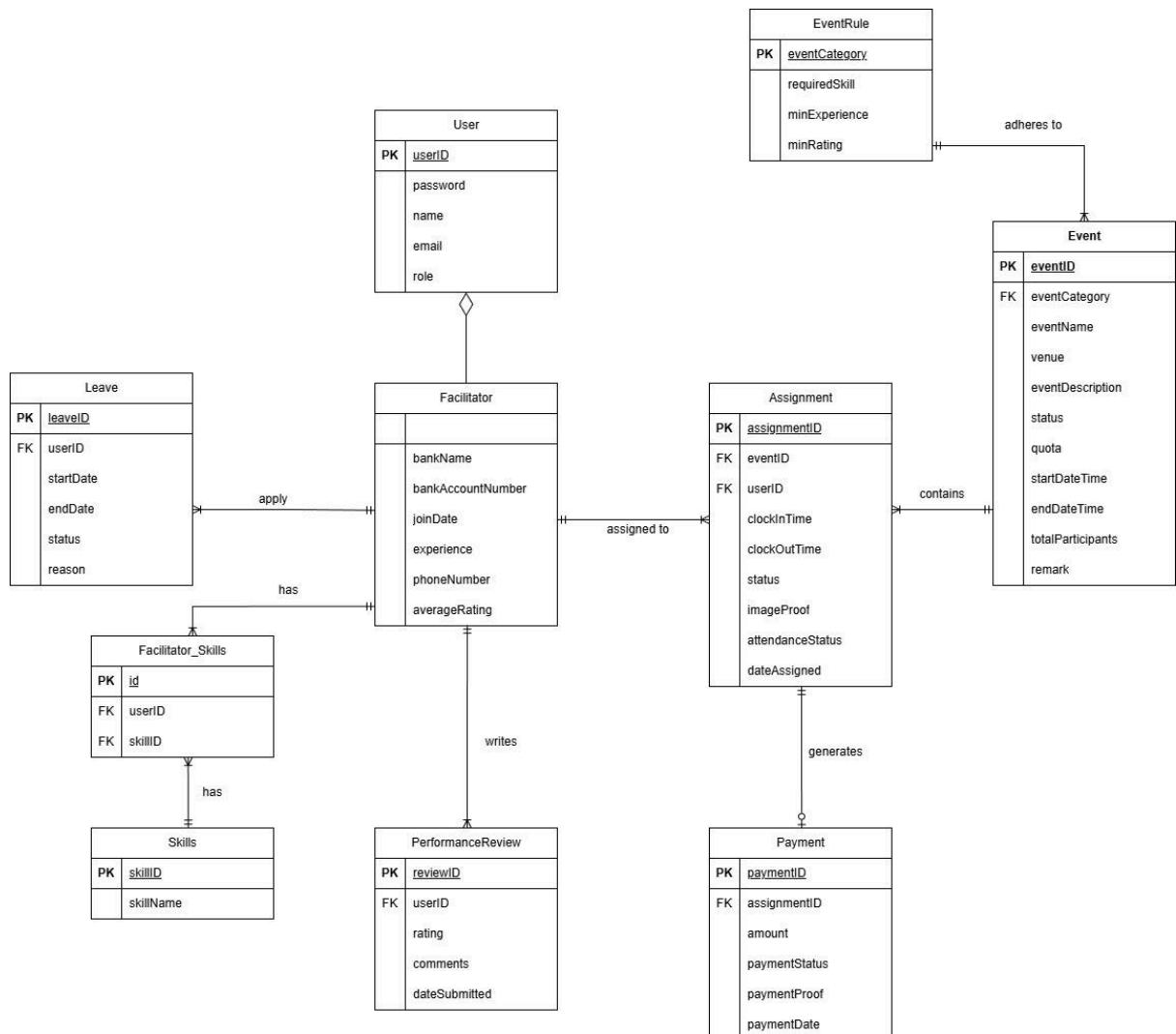


Figure 8.1 Relational Tables for Workforce Management System using Rule-Based System