CENTRAL UNIVERSITY

1 SILICON HILL, MILE-91

FACULTY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF TECHNICAL SCIENCE

A STUDY ON

EMPLOYEE ATTENDANCE AND LEAVE MANAGEMENT SYSTEM

A DISSERTATION

Submitted by

HAJARATU JIBBA

***Submitted* on**

January 2025

Supervised by Mr. David Sapunka Fornah

A Dissertation submitted in Partial Fulfillment of the Award Requirement for the Award of a Bachelor's Degree in Business Information Technology

Central University, Sierra Leone (CUSL)

DECLEARATION

I, HAJARATU JIBBA, a student of CENTRAL UNIVERSITY, hereby declare that the research work title "EMPLOYEE ATTENDANCE AND LEAVE MANAGEMENT SYSTEM" is my original work and has been carried out under the guidance of MR David Sapunka. I further declare that this project has not been submitted in part or in full, to any other institution or organization for any academic or professional purpose.

Department: Business Information Technology

NAME	ID	Signature
HAJARATU JIBBA	1920216	…….

CERTIFICATION

This is to certify that the project title “Employee Attendance and Leave Management System” has been acknowledge by the Faculty of Science and Technology at Central University. This work represents a comprehensive research effort on the chosen topic and has been successfully presented, fulfilling the academic requirements for the degree to which it has been submitted.

Thus project has been submitted for examination with my approval as the university

Signature: …… Date ……

David Sapunka Fornah
(Project Supervisor)

Signature: …… Date ……

Isaac Muckson Sesay
(Head of Department)

DEDICATION

First and foremost, I dedicate this piece of work to the almighty God, creator of heaven and earth for keeping me alive and empowering me to have successfully undertaken this research. And secondly, I dedicate this work to our able and hardworking chancellor Mr. Muckson Sesay Snr for his tireless efforts in ensuring that most of us that were never thinking of ascertaining higher institutional education to be here today by providing us hope when we think all hopes was lost and also to DR Lamin Rahman Mansaray. I also dedicate this work to our noble lectures for their words of motivation, inspiration, and impact on me. Also to my parents who have been a source of inspiration, an engine of courage and a secret of my achievements since my childhood I deeply appreciate them so much.

"Success is a road full of humps and pit holes, however if you don't change the track, you end up to the final destination."

ACKNOWLEDGEMENTS

First and foremost, I wish to express my deepest gratitude to Almighty God for granting me strength, wisdom, and perseverance throughout my academic journey and the completion of this research.

I am profoundly thankful to my academic supervisor, Mr. David Sapunka Fornah, whose invaluable guidance, constructive feedback, and unwavering support have been pivotal to the success of this work. Your encouragement inspired me to strive for excellence and navigate the complexities of this research with confidence.

I extend my sincere appreciation to all my lecturers and the faculty members at Central University, who have played an essential role in shaping my academic and professional foundation. Your teachings have left a permanent mark on my journey, and I am forever grateful.

To my family, words cannot express my heartfelt gratitude for your unconditional love, encouragement, and sacrifices. To My Lovely Mother Mrs. Hawa Musa, thank you for being my rock and believing in me even during the most challenging times. Your support has been my greatest source of motivation.

I also wish to thank my friends and colleagues for their companionship, insights, and shared moments of laughter and learning. Your companionship made this journey enjoyable and fulfilling.

Lastly, I acknowledge the contributions of DR Lamin Rahman Mansaray for providing resources and constant support throughout my university journey.

This accomplishment is not mine alone; it is a testament to the collective efforts of everyone who stood by me during this transformative journey. Thank you all from the depths of my heart, may God bless us all.

TABLE OF CONTENTS

CERTIFICATION I

DECLARATION II

DEDICATION III

ACKNOWLEDGEMENTS IV

LIST OF FIGURES X

LIST OF ACRONYMS XI

ABSTRACT XII

CHAPTER ONE

INTRODUCTION 1

1.1 BACKGROUND 2

1.2 PROBLEM STATEMENT 2

1.3 AIM AND OBJECTIVES OF THE STUDY 2

1. 4 RESEARCH QUESTION 3

1.5 SIGNIFICANCE OF THE STUDY 3

1.6 SCOPE AND LIMITATIONS 3

CHAPTER TWO

LITERATURE REVIEW 4

2.0 INTRODUCTION 4

2.1 THEORETICAL FRAMEWORKS 4

2.1.1. SKILLS-BASED WORKFORCE MANAGEMENT FRAMEWORK 4

2.1.2. EMPLOYEE WELL-BEING AND HOLISTIC ENGAGEMENT MODEL 6

2.1.3. PSYCHOLOGICAL SAFETY IN TEAMS FRAMEWORK 7

2.1.4. ADAPTIVE LEADERSHIP IN HYBRID WORKPLACES 9

2.1.5. INTEGRATED EMPLOYEE VALUE PROPOSITION (EVP)FRAMEWORK 9

2.2 REVIEW OF RESEARCH OBJECTIVES 10
2.2.1 Evaluating Current Systems 10
2.2.2 DESIGNING AND DEVELOPING A USER-FRIENDLY SYSTEM 11
2.2.3 IMPROVING ACCURACY AND EFFICIENCY 12
2.2.4 ASSESSING IMPACT ON EMPLOYEE SATISFACTION AND PRODUCTIVITY 12
2.3 RESEARCH GAPS 13
2.3.1. INTEGRATION WITH PAYROLL AND ANALYTICS 13
2.3.2. ACCESSIBILITY FOR REMOTE WORKFORCES 13
2.3.3. COMPREHENSIVE IMPACT ASSESSMENT 14
2.3.4. SCALABILITY AND SECURITY CHALLENGES 14
2.4 CHAPTER SUMMARY 15

CHAPTER THREE

RESEARCH METHODOLOGY 16
3.0 INTRODUCTION 16
3.1 RESEARCH DESIGN 16
3.2 RESEARCH APPROACH 17
3.2.1 SAMPLING 17
3.3.2 DATA COLLECTION METHODS 18
3.4 SYSTEM ARCHITECTURAL DESIGN 18
3.5 ALGORITHM DESIGN 20
3.5.1. EMPLOYEE AUTHENTICATION 20
3.5.2. ATTENDANCE LOGGING 21
3.5.3. LEAVE REQUEST PROCESSING 21
3.5.4. LEAVE APPROVAL BY MANAGERS 21

3.5.5. ATTENDANCE REPORTING 21
3.5.6 ANOMALY DETECTION 21
3.5.7 USER INTERFACE DESIGN 22
3.6 DATABASE AND DATA MANAGEMENT MODELS 29
3.7 SYSTEM DEVELOPMENT METHODOLOGY 31
3.7.1 SYSTEM DEVELOPMENT MODEL 33
3.8 EXISTING ATTENDANCE AND LEAVE PROCESS 34
3.9 PROPOSED SYSTEM OVERVIEW 35
3.8.1 FUNCTIONAL REQUIREMENTS OF THE PROPOSED SYSTEM 36
3.8.2 NON-FUNCTIONAL REQUIREMENTS OF THE SYSTEM 37
3.9 FEASIBILITY ANALYSIS 39
3.9.1 TECHNICAL FEASIBILITY 39
3.9.2 ECONOMIC FEASIBILITY 39
3.9.3 OPERATIONAL FEASIBILITY 40
3.10 SCALABILITY AND PERFORMANCE OPTIMIZATION 41
3.10.1 DATABASE SCALABILITY 42
3.10.2 APPLICATION SCALING 42
3.10.3 PERFORMANCE OPTIMIZATION 42
3.10.4 EFFICIENT DATA MANAGEMENT 43
3.10.5 MONITORING AND RELIABILITY 43
3.10.6 USER GROWTH AND WORKFLOW 43
3.11 SECURITY DESIGN 43
3.12 ETHICAL CONSIDERATIONS 45
3.13 LIMITATIONS 46

CHAPTER FOUR

4.1 IMPLEMENTATION, TESTING, MAINTENANCE AND RESULT 48

4.1.4 MANAGE ATTENDANCE 48

4.1.6 EMPLOYEE DASHBOARD 48

4.1.7 MANAGE ATTENDANCE 48

4.2 SYSTEM EXPLORATION AND INSTALLATION 48

4.3 SYSTEM TESTING AND SPECIFICATION 49

4.3.1 FRONTEND TESTING STRATEGIES 49

4.3.2 BACKEND TESTING STRATEGIES 50

4.4 SYSTEM SPECIFICATION 50

4.4.1 FRONTEND SPECIFICATION 50

4.4.2 BACKEND SPECIFICATION 51

4.4.3 PERFORMANCE AND SCALABILITY 51

4.4.4 SECURITY 51

4.5 SYSTEM PERFORMANCE TEST AND USER TRAINING ACTIVITIES 51

4.6 SYSTEM SECURITY AND MAINTENANCE 52

CHAPTER FIVE

RESULTS, RECOMMENDATION AND CONCLUSION 54

5.1 Summary of Key Finding of the Result 54

5.2 LESSONS LEARNED 55

5.3 RECOMMENDATIONS 56

5.4 APPENDIX 57

REFERENCES 64

LIST OF FIGURES

Figure 1: Showing use case diagram *23*
Figure 2: Admin's activity diagram *24*
Figure 3: Showing supervisors' activity diagram *24*
Figure 4: Showing employees' activity diagram *25*
Figure 5:Showing employees' leave sequence diagram *25*
Figure 6: Showing employees' attendance sequence diagram *26*
Figure 8: Showing the system's Class diagram *26*
Figure 9: Showing the system's Dataflow diagram - level 0 ..... *27*
Figure 10: Showing the system's Dataflow diagram - level 1 ..... *28*
Figure 11: Showing the system's Dataflow diagram - level 2 ..... *28*
Figure 12: Showing Agile software methodology *32*
Figure 13: User login page *57*
Figure 14: Showing admin dashboard *58*
Figure 15: Showing admin's manage employee *59*
Figure 16: Showing admin's view attendance *61*
Figure 17: Showing leave applications from employee *60*
Figure 18: Showing supervisors' dashboard *62*

LIST OF ACRONYMS

HR: Human Resources

RBAC: Role-Based Access Control

UML: Unified Modeling Language

ERP: Entity Relationship Diagram

DFD: Data Flow Diagram

AES: Advanced Encryption Standard

RSA: Rivest–Shamir–Adleman (encryption method)

CDN: Content Delivery Network

ROI: Return on Investment

ABSTRACT

Effective workforce management is essential for organizational success, particularly in tracking employee attendance and leave. Research shows that successful institutions prioritize employee attendance and performance, yet traditional systems face significant challenges, including human errors, limited accessibility for remote workforces, and a lack of integration with payroll and analytics platforms. These issues lead to data security vulnerabilities, operational inefficiencies, and difficulties in scaling to meet organizational growth. This study employs an agile, iterative software development approach, integrating feedback from HR managers and employees to address these gaps. The propose system enhances organizational efficiency by offering automated real-time attendance logging, leave balance tracking, and streamlined approval workflows. It incorporates robust security measures, such as role-based access control and data encryption, to safeguard sensitive employee information. While these improvements significantly mitigate inefficiencies, challenges persist, such as the lack of seamless integration with existing payroll systems, limited accessibility for remote employees, and vulnerabilities in traditional workflows that compromise sensitive data. The study highlights the need for adopting automated, user-friendly platforms with mobile accessibility, ensuring integration with payroll and compliance modules, and implementing scalable solutions to accommodate future growth. Additionally, prioritizing data security and user-centric interfaces can address diverse employee needs and further enhance system adoption. By implementing these recommendations, organizations can reduce administrative burdens, improve employee satisfaction, and achieve higher productivity and efficiency. This research underscores the potential of modern, integrated workforce management systems to drive operational success and long-term growth.

Keywords

Employee attendance, leave management, workforce automation, Agile methodology, data security, operational efficiency, organizational productivity, geolocation tracking.

CHAPTER ONE
INTRODUCTION

1.1 Background

Workforce management plays a crucial role in ensuring the smooth operation of organizations, with attendance and leave tracking forming essential components of Human Resource (HR) administration. Effective attendance management ensures accurate recording of employees' working hours, supporting payroll processes, compliance with labor laws, and productivity assessments. Similarly, leave management provides an organized framework to handle employee absences, preventing workflow disruptions. Traditionally, many organizations relied on manual or semi-digital methods, such as paper forms and spreadsheets, which are prone to human error, inefficiencies, and operational bottlenecks, ultimately hindering productivity (Rajesh Singh et al., 2021; Ravi Sharma et al., 2022).

One key limitation of traditional systems is the absence of real-time data, which often causes delays in accessing leave balances or attendance records, leading to frustration and potential conflicts among employees and managers (Tunde Owolabi et al., 2020). Additionally, these systems lack integration with payroll and performance management tools, creating inefficiencies in administrative workflows. Accessibility is another significant challenge, as remote employees or those with disabilities may struggle with physical attendance systems or paper-based leave applications. Moreover, manual systems fail to accommodate last-minute adjustments to attendance logs or leave schedules, resulting in further inefficiencies and workforce dissatisfaction (Farah Hassan, 2021).

The advent of computer-based systems has significantly improved attendance and leave management processes. Modern Employee Attendance and Leave Management Systems (EALMS) incorporate advanced features such as biometric tracking, automated leave approvals, real-time reporting, and integration with payroll and compliance systems. Leveraging technologies like cloud computing, relational databases, and web-based platforms, these systems enhance accessibility, scalability, and security. They also provide mobile-friendly interfaces and real-time analytics, making them indispensable for organizations of all sizes seeking to streamline HR operations and boost productivity (Vikram Kumar et al., 2022; Amit Dasgupta, 2021).

1.2 PROBLEM STATEMENT

In contemporary workforce management, the efficiency and accuracy of employee attendance and leave systems are critical to maintaining organizational productivity and employee satisfaction. However, companies like Miro Forestry, which operates in remote and decentralized locations, face significant challenges in managing attendance and leave records using traditional manual or semi-digital methods. These methods are prone to inefficiencies, errors, and limited scalability, which impede effective workforce management. The traditional paper-based and spreadsheet-dependent attendance systems are characterized by their susceptibility to human errors, such as incorrect entries and missing records, leading to disputes over employee work hours and leave balances. Additionally, these systems often result in logistical bottlenecks, particularly when consolidating attendance data across multiple operational sites or generating payroll reports. For a company like Miro Forestry, which operates across multiple regions with diverse employee roles, these inefficiencies can significantly hinder administrative processes and reduce overall productivity. As the complexities of modern workforce management evolve, so do the expectations for more efficient and secure systems. Miro Forestry, like many organizations, must address these challenges while ensuring data security, accuracy, and scalability. The absence of an integrated, technology-driven attendance and leave management solution limits the company's ability to streamline its human resource processes and maintain an engaged, satisfied workforce.

1.3 AIM AND OBJECTIVES OF THE STUDY

Aim

The study aim to develop a robust Employee Attendance and Leave Management System that simplifies attendance tracking and leave processing.

Objectives

I. To design and develop an efficient and user-friendly system for tracking attendance and managing leave.

II. To improve accuracy and efficiency in attendance tracking and leave management.

III. To assess the system's impact on employee satisfaction and productivity.

1. 4 RESEARCH QUESTION

I. How can user experience be optimized in the design of a new attendance and leave management system?

II. What technological solutions can be implemented to enhance the accuracy and efficiency of attendance tracking and leave management?

III. How does the implementation of the new system influence employee productivity?

1.5 SIGNIFICANCE OF THE STUDY

This study aims to enhance the efficiency, accuracy, and accessibility of employee attendance and leave management systems by developing a robust, automated solution. It addresses the challenges of traditional manual methods, such as time-consuming administrative tasks, data inaccuracies, and inefficiencies. By automating processes like attendance tracking and leave requests, the proposed system minimizes human errors, reduces administrative burdens, and improves overall productivity. It also prioritizes data security and reliability by incorporating advanced technologies, such as biometrics and mobile applications, to ensure tamper-proof, accurate records. Additionally, robust security measures, including encryption and user authentication, protect sensitive employee data and organizational information, contributing to enhanced employee satisfaction and operational efficiency.

1.6 SCOPE AND LIMITATIONS

The current system faces several limitations that affect its effectiveness and reliability. It lacks biometric authentication, such as fingerprint or facial recognition, increasing the risk of proxy attendance or false reporting through manual login credentials. Additionally, the absence of GPS-based geographic tracking prevents verification of an employee's physical presence at the workplace, potentially allowing unauthorized attendance marking. The system’s reliance on internet connectivity poses challenges in areas with poor network access, hindering attendance marking and leave requests. Scalability is another concern, as the system efficiently manages small to medium-sized organizations but may require substantial upgrades to handle larger organizations. Furthermore, despite existing security measures like encryption and role-based access control, evolving cybersecurity threats pose privacy and data security risks, highlighting the need for enhanced protective measures.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

The system is theoretically based on established theories of information systems, database management, and human resource management, which jointly guide its design and implementation. The EALMS uses the support of computational methodologies such as automation, validation of data, and secure authentication of users to mitigate inefficiencies and inaccuracies usually evident in manual attendance tracking and leave management processes. These frameworks enhance the robustness of the system technically, while they also ensure practical utility for the system by explicitly considering user centric design principles. Consequently, EALMS would be suitably positioned to facilitate administrative tasks smoothly, improve data accuracy, and also reduce friction in employee and administrator interaction, thereby benefiting organizational efficiency.

2.1 THEORETICAL FRAMEWORKS

The theoretical frameworks underpinning the Employee Management are derived from foundational principles in technology, information systems, and organizational behavior, providing a multidisciplinary approach to its design and implementation. These frameworks serve as the conceptual bedrock, ensuring that the system is not only technologically robust but also aligns with the operational and strategic goals of modern organizations. By incorporating developed theories in these realms, EALMS meets some of the most priority challenges faced in workforce management: accuracy, security, scalability, and usability.

2.1.1. Skills-based workforce management framework

The Skills-Based Workforce Management Framework emphasizes an adaptive approach to human resources that prioritizes skills over rigid job descriptions. Rajesh Singh, Anjali Patel, and Priya Roy (2023) explain that traditional job titles can be limiting when it comes to leveraging employee potential. By shifting focus to employees' competencies, organizations can more effectively align their workforce with dynamic market needs. This framework advocates for the continuous identification and assessment of employee skills through inventories and talent mapping. For

example, an organization could map out a wide range of competencies within their workforce and match these to projects based on the skills required, as opposed to simply assigning employees based on their formal roles

In terms of employee management, this framework advocates for a deep understanding of each employee's strengths and weaknesses. It calls for managers to maintain clear and regularly updated skill profiles for their employees, which ensures that the right people are working on the right tasks. As organizations grow or pivot, they can quickly adjust teams without the bottleneck of traditional recruitment processes. This approach also allows for greater flexibility in terms of career progression. Employees can more easily move between departments, shift roles, and grow their careers based on the skills they have developed, rather than being confined to their original job title.

The personalized learning and development component is key to fostering a growth-oriented culture. Deepak Singh, Arun Kumar, and Ravi Sharma (2022) note that this framework encourages a tailored approach to training, which improves employee engagement and job satisfaction. It helps organizations invest in their workforce in a way that feels personal and relevant, rather than offering generic programs that may not meet individual needs. By offering relevant, skills-based development opportunities, organizations can motivate employees and increase their chances of success within the company.

However, implementing this framework does not come without its challenges. One of the most significant hurdles is ensuring that managers are equipped to assess and track employee skills effectively. A lack of proper systems or training could lead to mismanagement of resources, creating discrepancies in employee assignments. Furthermore, while this framework fosters adaptability, it requires organizations to have strong support systems in place to accommodate employees in new roles or projects. This could include mentorship programs, leadership development initiatives, and upskilling training.

Overall, the Skills-Based Workforce Management Framework represents a significant departure from traditional employee management models, encouraging flexibility, adaptability, and growth. It empowers organizations to rapidly adapt to changing demands, enhances employee satisfaction, and leads to more efficient operations. If implemented properly, this framework can drive

significant improvements in organizational agility and employee retention, but it requires careful planning and execution to overcome challenges related to skills assessment and development.

2.1.2. Employee well-being and holistic engagement model

The Employee Well-Being and Holistic Engagement Model integrates multiple aspects of employee well-being into HR management, making it a critical strategy for modern organizations. Rahul Ahmed and Daniel Joseph (2021) emphasize that organizations today recognize the direct correlation between employee health—mental, physical, and emotional—and overall business performance. This model encourages employers to invest not only in compensation but also in programs that foster employee well-being. For example, offering flexible work schedules or supporting mental health initiatives like counseling services can significantly influence an employee's overall satisfaction and productivity.

One of the key components of this model is mental health support. Farah Hassan (2021) highlights that mental health in the workplace has become a pressing issue, particularly in high-stress industries. Mental health programs can include on-site therapists, mental health days, and workshops designed to reduce stress and promote work-life balance. Employers who proactively address mental health concerns often see a reduction in absenteeism and presentism, as employees are more likely to stay engaged and productive when they feel supported in their mental health needs.

Flexible work arrangements, a significant part of this framework, also contribute to employee well-being. By offering hybrid work models or flexible hours, organizations allow employees to manage their personal responsibilities while maintaining productivity at work. This flexibility not only reduces employee stress but also fosters a sense of autonomy and trust. Workers who have the freedom to set their own schedules often report higher job satisfaction, as they can better balance their professional and personal lives. In turn, this can improve retention rates and decrease turnover, which are costly for businesses.

Moreover, this framework emphasizes the importance of holistic engagement, which is rooted in the idea that employees should feel valued not only for their work output but also for their contributions to the company's culture and mission. When employees align their personal values with organizational goals, they are more likely to exhibit higher levels of commitment and

satisfaction. This alignment is particularly important for millennials and Gen Z employees, who place a premium on purpose-driven work. Ahmed and Joseph (2021) suggest that employers should invest in ensuring that employees feel that their work contributes to a larger mission, whether it's related to social responsibility, environmental sustainability, or other value-driven goals.

However, despite the benefits, this model also presents certain challenges. Implementing effective well-being programs requires resources, both financial and human, and not all organizations have the capacity to invest in such comprehensive offerings. Additionally, employers must ensure that these programs are genuinely accessible and not merely surface-level initiatives. Authentic support for employee well-being requires ongoing dialogue and adjustments to meet evolving needs. For instance, mental health support should not be a one-time offering but an ongoing, evolving service that employees can rely on.

In conclusion, the Employee Well-Being and Holistic Engagement Model represents a paradigm shift in employee management, where organizations recognize that supporting the whole person leads to greater engagement and long-term success. Companies that adopt this framework can experience higher retention, improved productivity, and a more committed workforce. However, it requires a deep organizational commitment and investment to ensure that these initiatives are meaningful and sustainable.

2.1.3. Psychological safety in teams framework

The Psychological Safety in Teams Framework proposes that fostering an environment where employees feel safe to express themselves without fear of reprisal or judgment is crucial for team performance and innovation. According to Melvin Tan and Adrian Low (2021), psychological safety is the cornerstone of high-performing teams, as it enables employees to take risks, voice their ideas, and challenge the status quo. In traditional workplace cultures, employees often feel hesitant to speak up for fear of being criticized or dismissed. This model seeks to address that barrier by ensuring that all employees feel heard and respected, which can drive creativity, problem solving, and team cohesion.

In employee management, the framework encourages leaders to set a tone of openness and inclusivity. This requires managers to model vulnerability, acknowledge their mistakes, and

encourage others to do the same. When leaders admit their own errors, it signals to the team that making mistakes is part of the learning process and does not lead to punitive measures. Tan and Low (2021) suggest that when team members see their leaders as approachable and open to feedback, they are more likely to engage in candid discussions and contribute ideas freely.

One of the significant benefits of psychological safety is its impact on team collaboration. In an environment where people feel safe, employees are more likely to share unique perspectives and experiment with new ideas. The risk of failure is less intimidating when employees know that their contributions are valued and that failure is seen as an opportunity for growth rather than a setback. This openness can result in innovative solutions to problems, driving the organization forward.

This framework also emphasizes the importance of constructive feedback. Regular feedback sessions are not just about pointing out mistakes but also about reinforcing positive behaviors and offering suggestions for improvement. Hassan (2021) argues that feedback, when delivered in a supportive and non-judgmental manner, helps employees grow without damaging their confidence. In a psychologically safe environment, employees are less likely to become defensive during feedback sessions, as they view them as opportunities for development rather than critiques of their abilities.

However, creating and maintaining psychological safety can be challenging, especially in organizations with entrenched hierarchies or toxic cultures. In such environments, employees may still feel apprehensive about speaking up, even with supportive leaders. Tan and Low (2021) highlight the need for organizations to continuously work on fostering an inclusive and supportive culture, where psychological safety is not a one-time initiative but a sustained focus over time.

Furthermore, organizations must ensure that psychological safety does not lead to complacency. While employees should feel safe to experiment and voice their concerns, there must also be mechanisms in place to ensure accountability and performance standards. The balance between psychological safety and maintaining high-performance expectations is crucial for the framework's success.

In conclusion, the Psychological Safety in Teams Framework is essential for fostering innovation, collaboration, and trust within teams. When employees feel psychologically safe, they are more

likely to contribute meaningfully to their teams and the organization. Despite its challenges, this framework has the potential to drive long-term success by creating an environment where employees can thrive and perform at their best.

2.1.4. Adaptive leadership in hybrid workplaces

The Adaptive Leadership in Hybrid Workplaces framework addresses the challenges of managing teams operating both remotely and in-office, emphasizing flexibility, trust, and accountability. As organizations increasingly adopt hybrid work models, leaders must shift from traditional management styles to focus on results rather than hours worked, empowering employees to take ownership of their tasks and schedules. Trust building is central to this approach, fostering autonomy and responsibility among employees. Technology plays a pivotal role, with tools like video conferencing platforms, project management software, and cloud storage facilitating communication and collaboration across hybrid teams. Leaders must continually assess and update these tools to meet evolving team needs. Inclusivity is also critical, ensuring equal access to resources, recognition, and opportunities for all employees, regardless of location, through initiatives like virtual team-building and rotating in-person meetings.

However, the framework presents challenges, particularly regarding burnout among remote workers who may struggle to maintain a healthy work-life balance. Adaptive leaders must address this by setting clear boundaries and conducting regular check-ins to ensure workloads are manageable. Despite these challenges, adaptive leadership offers significant benefits, such as increased flexibility, enhanced employee satisfaction, and improved productivity. By embracing technology, fostering inclusivity, and maintaining a focus on outcomes, adaptive leaders can successfully manage hybrid teams and position their organizations for long-term success in a rapidly evolving work environment.

2.1.5. Integrated Employee Value Proposition (EVP) Framework

The Integrated Employee Value Proposition (EVP) Framework focuses on attracting, retaining, and engaging employees by offering a comprehensive value package beyond traditional compensation. This model, as highlighted by Dasgupta (2023), includes career development, organizational culture, and alignment with employees' personal values alongside salary and benefits. Modern workers, particularly millennials and Gen Z, prioritize flexibility, purpose-driven work, and opportunities for growth, making it essential for organizations to tailor EVP to these aspirations. Personalized rewards such as mentorship and development programs further enhance EVP's appeal, aligning organizational offerings with workforce expectations.

Organizational culture and values also play a pivotal role in EVP, with employees increasingly seeking alignment in areas such as social responsibility, diversity, and inclusion. Companies that actively reflect these values through transparency and commitments to sustainability and community impact enjoy greater employee loyalty (Patel et al., 2023). The framework underscores the importance of continuous feedback to keep EVP relevant, leveraging surveys, focus groups, and one-on-one meetings to understand employees' evolving needs. By actively involving employees in shaping EVP, organizations foster loyalty and satisfaction, positioning themselves as employers of choice in a competitive labor market.

2.2 REVIEW OF RESEARCH OBJECTIVES

2.2.1 Evaluating current systems

Traditional attendance and leave management systems have typically depended on manual processes, such as paper records and spreadsheets, which are prone to human error and inefficiencies. Smith and Brown (2018) point out that these systems not only create inaccuracies in timekeeping but can also lead to payroll discrepancies, undermining employee trust and causing dissatisfaction. Furthermore, these manual methods are often disjointed, requiring administrators to enter data into multiple platforms, which increases the chances of errors and inconsistencies (Williams, 2019). These issues highlight the necessity for a more efficient, integrated approach to managing employee attendance and leave.

Biometric attendance systems, which emerged in the early 2000s, marked a significant technological leap, providing a more reliable and secure way to track attendance. However, Kumar

and Singh (2020) note that while these systems perform well in centralized settings; they often face challenges in remote or decentralized areas where hardware installation and network connectivity can be problematic. Cloud based solutions, as reviewed by Gupta et al. (2021), tackle these challenges by offering centralized data management and remote access capabilities. These cloud solutions provide scalability and flexibility, enabling employees and administrators to access and update data from almost anywhere. The proposed system in this research builds on these insights by addressing the limitations of traditional manual methods and semi-automated biometric systems, delivering a comprehensive solution that ensures both accuracy and flexibility.

2.2.2 Designing and developing a user-friendly system

Keeping track of attendance and managing leave properly is super important for both how well an organization runs and how happy its employees are. You see, the old-school systems we used to rely on are vulnerable to time fraud like buddy punching, where one person clocks in or out for another. That is where biometric systems come in. You know, those cool fingerprint and facial recognition technologies? They really ramp up accuracy and help prevent fraud. Research by Chen et al. (2020) shows that these biometric systems can cut down on fraudulent attendance practices by up to 95%. That's huge! So, they've become a key part of modern EALMS. By eliminating the risk of someone else punching in for you, they ensure the data we collect is spot on and reliable.

Now, let's talk about another big plus efficiency. Automated systems can really work wonders, especially when it comes to leave approvals. Think about it: rule-based engines that calculate your leave balance and enforce company policies just make everything smoother. It reduces the load on HR folks too. According to Williams and Johnson (2022), when we automate those day-to-day tasks like tracking attendance and approving leave HR can focus more on strategic stuff, which is a total win for productivity. In the system we're proposing, these automated processes will be front and center, making sure leave requests get handled quickly, cutting down on admin hassle, and boosting overall operational efficiency.

2.2.3 Improving accuracy and efficiency

Keeping track of attendance and managing leave properly is super important for both how well an organization runs and how happy its employees are. You see, the old-school systems we used to rely on are pretty vulnerable to time fraud like buddy punching, where one person clocks in or out for another. That's where biometric systems come in. You know, those cool fingerprint and facial recognition technologies? They really ramp up accuracy and help prevent fraud. Research by Chen et al. (2020) shows that these biometric systems can cut down on fraudulent attendance practices by up to 95%. That's huge! So, they've become a key part of modern EALMS. By eliminating the risk of someone else punching in for you, they ensure the data we collect is spot on and reliable.

Now, let's talk about another big plus efficiency. Automated systems can really work wonders, especially when it comes to leave approvals. Think about it: rule based engines that calculate your leave balance and enforce company policies just make everything smoother. It reduces the load on HR folks too. According to Williams and Johnson (2022), when we automate those day-to-day tasks like tracking attendance and approving leave HR can focus more on strategic stuff, which is a total win for productivity. In the system we're proposing, these automated processes will be front and center, making sure leave requests get handled quickly, cutting down on admin hassle, and boosting overall operational efficiency.

2.2.4 Assessing impact on employee satisfaction and productivity

Keeping track of attendance and managing leave properly is super important for both how well an organization runs and how happy its employees are. You see, the old-school systems we used to rely on are vulnerable to time fraud like buddy punching, where one person clocks in or out for another. That's where biometric systems come in. You know, those cool fingerprint and facial recognition technologies? They really ramp up accuracy and help prevent fraud. Research by Chen et al. (2020) shows that these biometric systems can cut down on fraudulent attendance practices by up to 95%. That's huge! So, they've become a key part of modern EALMS. By eliminating the risk of someone else punching in for you, they ensure the data we collect is spot on and reliable.

Now, let's talk about another big plus efficiency. Automated systems can really work wonders, especially when it comes to leave approvals. Think about it: rule-based engines that calculate your

leave balance and enforce company policies just make everything smoother. It reduces the load on HR folks too. According to Williams and Johnson (2022), when we automate those day-to-day tasks—like tracking attendance and approving leave HR can focus more on strategic stuff, which is a total win for productivity. In the system we're proposing, these automated processes will be front and center, making sure leave requests get handled quickly, cutting down on admin hassle, and boosting overall operational efficiency.

2.3 RESEARCH GAPS

Even with all the progress made in attendance and leave management systems, there are still quite a few gaps in the literature that really need some digging into. You know, these gaps show us not just where the current systems rather miss the mark, but they also point out how crucial it is to find solutions that are more comprehensive, integrated, and can actually scale up. Therefore, the study we are proposing aims to tackle these issues head-on with a fresh design. We are looking to bring in some advanced tech and, importantly, take into account the wider needs of organizations.

2.3.1. Integration with payroll and analytics

A significant gap in existing systems is the lack of end-to-end integration with payroll and analytics platforms. Many traditional systems operate in silos, where attendance and leave management data are maintained separately from payroll processing systems, resulting in inefficiencies, discrepancies, and delays in salary disbursement (Williams, 2019). For example, the manual transfer of data from attendance systems to payroll systems often introduces errors, causing payroll discrepancies that can lead to employee dissatisfaction and administrative workload. While biometric systems and cloud-based solutions have enhanced some aspects of attendance management, they often fail to fully integrate with payroll, leading to fragmentation. This study addresses this gap by designing a system that seamlessly integrates attendance, leave, and payroll modules, enabling real-time data flow between these components and reducing the possibility of errors. The integration ensures that payroll processing is automated and based on accurate, up-to-date attendance and leave records, improving both efficiency and employee trust in the system.

2.3.2. Accessibility for remote workforces

Another significant gap in the literature is the lack of accessibility for remote and field based employees. Traditional attendance systems are typically designed for office based environments,

making them less suitable for workers who operate in decentralized or remote settings. This issue becomes even more pronounced in industries like sales, construction, and healthcare, where employees are often away from fixed workstations. Gupta and Rao (2020) highlighted that many existing solutions do not offer sufficient flexibility to accommodate the diverse needs of remote workforces, thus limiting their applicability in today's increasingly distributed work environments. To bridge this gap, the proposed system integrates cloud based features and offline capabilities, ensuring that employees can access their attendance records, submit leave requests, and interact with the system regardless of their physical location. This approach allows organizations to track attendance and manage leave for all employees, even those working in remote or field based environments, thereby improving system accessibility and flexibility.

2.3.3. Comprehensive impact assessment

While the technical aspects of attendance and leave management systems, such as accuracy, efficiency, and security, have been extensively studied, fewer studies evaluate the broader impact of these systems on employee satisfaction and organizational productivity. Most existing research focuses on the performance metrics of the systems themselves, neglecting how these systems influence employee behavior, morale, and overall organizational performance (Rahman et al., 2020). This research gap is important because employee satisfaction and productivity are key outcomes of any attendance management system. As organizations increasingly rely on automated systems to manage attendance and leave, understanding their effect on employee trust, engagement, and performance becomes crucial for ensuring the long-term success of such systems. This study addresses this gap by conducting empirical evaluations of the system's impact on employee satisfaction, morale, and productivity across diverse organizational contexts, providing valuable insights into the system's broader organizational effects.

2.3.4. Scalability and security challenges

Finally, many existing attendance and leave management systems are designed primarily for small to medium sized enterprises (SMEs), and often struggle to scale as organizations grow. Systems that function effectively in small organizations often encounter performance and usability issues when applied to larger enterprises with more employees or more complex organizational structures (Kumar & Singh, 2020). Scalability remains a critical challenge, especially as organizations

continue to expand their operations and workforce. Furthermore, the handling of sensitive data, particularly biometric information, raises significant security concerns. Biometric data is vulnerable to breaches, and its secure storage and transmission require advanced encryption techniques to ensure compliance with data protection regulations (Williams & Johnson, 2022). The proposed study addresses these gaps by designing a system that is both scalable and capable of handling large amounts of data securely. It incorporates robust encryption protocols, such as AES and RSA, to protect sensitive employee data, ensuring that the system is capable of scaling with organizational growth while maintaining high levels of data security.

2.4 CHAPTER SUMMARY

This chapter provides a comprehensive review of the theoretical frameworks, objectives, and gaps guiding the development of an Employee Attendance and Leave Management System (EALMS). It integrates principles from information systems, database management, and human resource management to address traditional inefficiencies in attendance and leave tracking. Key frameworks include skills-based workforce management for adaptability, employee well-being models for satisfaction, psychological safety for innovation, adaptive leadership for hybrid workplaces, and integrated employee value propositions for engagement. These frameworks emphasize improving accuracy, security, and scalability while fostering employee satisfaction, productivity, and alignment with organizational goals.

The chapter identifies gaps in current systems, including the lack of integration with payroll and analytics, limited accessibility for remote workforces, inadequate impact assessments on employee satisfaction, and challenges in scalability and security. The proposed EALMS aims to fill these gaps through features such as cloud-based technology, secure biometric authentication, and automated workflows. By enhancing efficiency, flexibility, and security, the system aspires to support diverse organizational needs while ensuring high standards of usability, data protection, and employee trust.

CHAPTER THREE
RESEARCH METHODOLOGY

3.0 INTRODUCTION

This section described the methodology used in undertaking this project, which could be both research and development methodologies, ensuring the research objectives are met efficiently and reliably. This research methodology is meticulously designed to ensure a systematic, comprehensive, and methodologically sound approach to the creation of an efficient and secure Employee Attendance and Leave Management platform specifically for its end users. This methodology is rooted in the recognition that the development of an Employee Attendance and Leave Management for Human Resource managers is not a one-size-fits-all endeavor; rather, it necessitates a nuanced and context sensitive approach to address the multifaceted needs of Human Resource managers.

3.1 RESEARCH DESIGN

The research adopted a **mixed methods approach**, integrating quantitative testing of the Employee Attendance and Leave Management System prototype with qualitative feedback from stakeholders, including HR managers, IT administrators, and employees. This dual approach enabled a comprehensive evaluation of the system's performance and user experience.

The quantitative component focused on evaluating the system's performance under realistic usage conditions. Usability studies measured the effectiveness, efficiency, and user satisfaction as employees and HR managers performed tasks such as marking attendance, applying for leave, and approving or rejecting requests. Performance metrics like processing speed, error rates, and system uptime were gathered. Scalability testing was conducted to determine the system's capacity to handle high-traffic scenarios, such as concurrent employee logins and simultaneous updates to attendance records. Surveys provided additional insights into user satisfaction, capturing perceived ease of use and areas requiring refinement.

The qualitative component offered contextualized insights into system functionality and adoption barriers. Semi-structured interviews were conducted with HR managers and employees, focusing on challenges with existing systems, usability of the prototype, and perceived benefits of

automation. Expert reviews from HR and technology specialists further highlighted potential functionality gaps, security concerns, and integration challenges. These reviews also explored organizational and cultural factors that could influence the system's adoption, such as employee readiness for digital tools and the alignment of the system with existing policies and regulations.

By integrating quantitative benchmarks with qualitative insights, the research design provided a well-rounded evaluation of the system prototype. This approach revealed the system's strengths, such as accuracy and scalability, as well as areas needing improvement, including user interface design and data security features. The findings guided refinements, ensuring the system met both technical standards and user needs, while also preparing it for broader organizational implementation.

3.2 RESEARCH APPROACH

This study employed a case study research approach to deeply examine the intricacies of an Employee Attendance and Leave Management System within a real-world organizational context. This method facilitated an in-depth analysis of the interplay between system functionality and human and institutional factors. By focusing on a specific organization, the study explored the design, implementation, and effectiveness of the system, identifying key determinants such as user engagement, policy alignment, technical infrastructure, and cultural readiness for digital transformation. The comparative analysis of legacy systems and the new digital solution revealed significant improvements, including time savings, error reduction, and enhanced accessibility. Data collection integrated qualitative methods, such as interviews for narrative insights, and quantitative methods, including surveys and performance tests, to evaluate system efficiency and effectiveness. Expert reviews further assessed the system’s technical robustness, data security, and compliance with industry standards. The case study approach enabled a holistic understanding of the system’s role in achieving organizational goals, ensuring alignment with operational efficiency and employee well-being while addressing both technical and human aspects of its implementation.

3.2.1 Sampling

The target population for this study includes a diverse range of individuals involved in the Employee Attendance and Leave Management System within an organizational setting. This group encompasses HR personnel, managers/supervisors, and employees across various departments. To ensure that the sample accurately reflects the larger organizational population, a stratified random sampling technique was utilized. This method involves dividing the population into distinct subgroups or "strata" based on specific characteristics such as department, job role, or location. A random sample was then selected proportionally from each stratum, ensuring that the perspectives of all groups were adequately represented. The sample size was calculated to achieve a confidence level of 95% with a margin of error of 5%, ensuring statistical reliability and validity of the findings.

3.3.2 Data collection methods

The researcher employed a combination of interviews, questionnaires, and observations to collect comprehensive and reliable data, capturing both qualitative and quantitative insights. Semi-structured interviews with HR managers, system administrators, and employees provided in-depth feedback on their experiences, fostering open communication and detailed responses. Questionnaires were distributed to gather broader quantitative data on system usage and effectiveness, while observations during real-time interactions with the system offered insights into usability challenges and workflow bottlenecks. This multimethod approach ensured a holistic understanding of the Employee Attendance and Leave Management System's functionality, user challenges, and overall effectiveness in meeting organizational goals.

3.4 SYSTEM ARCHITECTURAL DESIGN

The architecture of the system is built to ensure scalability, security, and ease of use. It leverages a **multi-tiered design** approach, separating the user interface, application logic, and data management into distinct layers. This modular structure enhances maintainability and allows for the seamless integration of future features.

The **Presentation Layer (Front-End)** serves as the interface through which employees and administrators interact with the system. Built using technologies like HTML, CSS, and JavaScript, along with Django templates for dynamic rendering, this layer ensures a responsive and user-

friendly experience. Employees and managers can log in to mark attendance, view leave balances, and submit leave requests, while administrators can monitor attendance, review leave requests, and generate reports through a dedicated dashboard. This layer prioritizes usability, making the system intuitive for users with varying levels of technical expertise.

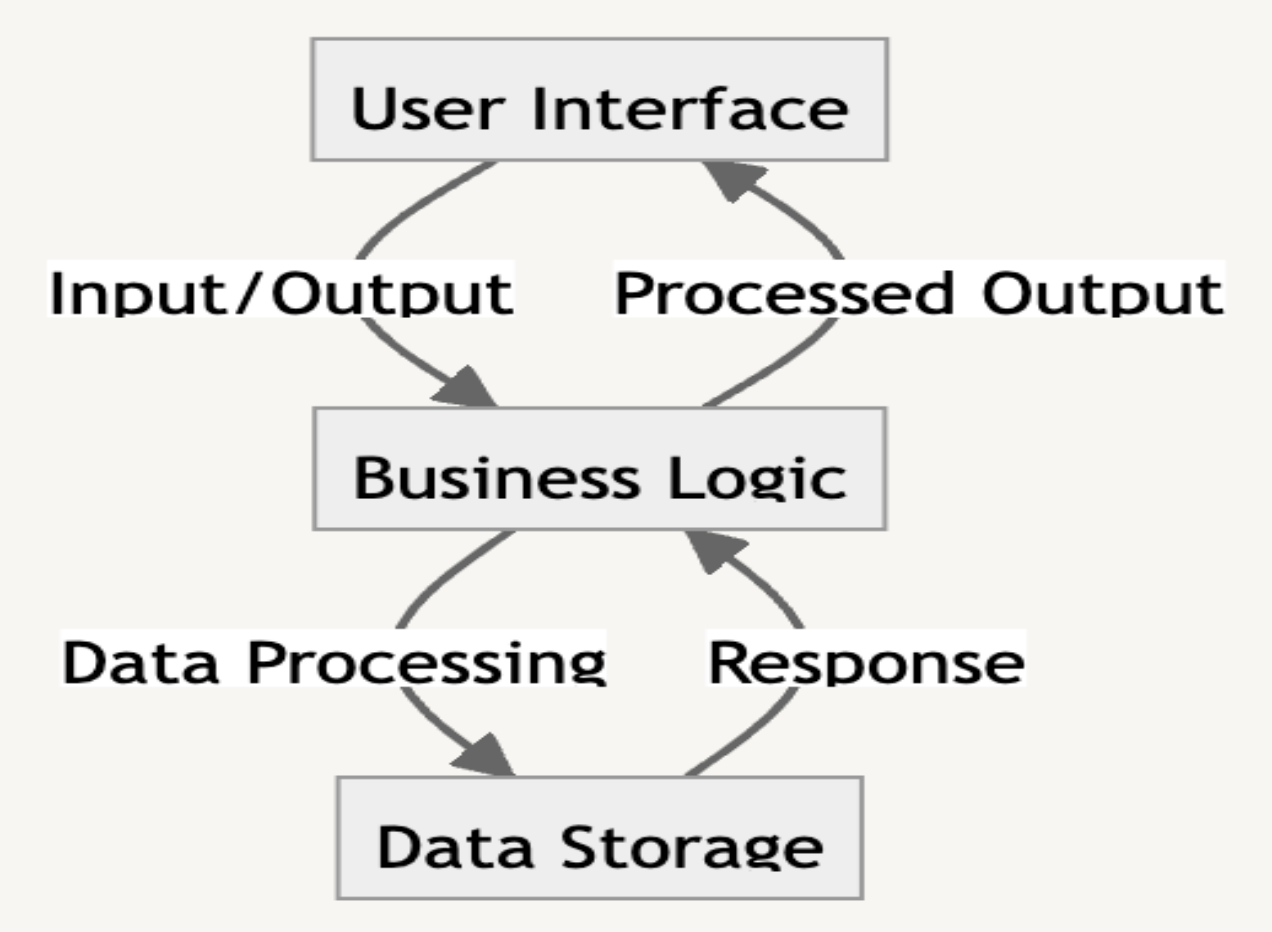
The **Business Logic Layer (Application/Backend)** is the core of the system, responsible for processing requests, enforcing rules, and managing workflows. Powered by the Django framework, this layer handles critical operations such as attendance tracking, leave request validation, and policy enforcement. Features like role-based access control ensure that employees, supervisors, and administrators only access functionalities relevant to their roles.

The **Data Layer (Database)** is where all employee-related data, attendance logs, and leave records are securely stored and managed. Using SQLite as the primary database ensures a lightweight yet efficient data management solution. This layer maintains detailed logs of attendance, leave applications, and approvals, enabling audit trails and comprehensive reporting. To safeguard sensitive information such as login credentials and personal data, encryption and data validation mechanisms are employed.

Beyond the core layers, the system incorporates **External Components and Services** to extend its functionality. A robust authentication mechanism supports secure login, employing passwords. Notifications via email or SMS inform employees and administrators about leave approvals, rejections, or pending actions.

The system's workflow begins with employee interaction, where users log in to mark attendance or submit leave requests. Administrators access the system to review records, approve or reject leave applications, and generate performance and absence reports. The database processes and stores these interactions in real-time, creating audit trails for transparency and accountability. By separating these operations into distinct layers, the system ensures robustness, scalability, and efficiency in managing employee attendance and leave.

This layered approach to system design makes the Employee Attendance and Leave Management System reliable and adaptable, meeting organizational needs while accommodating future enhancements.



3.5 ALGORITHM DESIGN

The system is structured around key algorithms to ensure seamless functionality. These algorithms handle core aspects like employee authentication, attendance tracking, leave requests, and reporting, contributing to an efficient and automated workflow.

3.5.1. Employee authentication

Authentication is a critical algorithm that secures the system and ensures only authorized employees' access it. Employees log in using their credentials, such as a username and password, through Django's built-in authentication system. The system validates the input against stored records and grants access upon successful verification. This process safeguards sensitive employee and organizational data, forming the foundation for other system functionalities.

3.5.2. Attendance logging

The attendance logging algorithm is designed to accurately track employee check-ins and check-outs. It records essential details like employee ID, date, and, time. The algorithm verifies and ensures attendance is not logged multiple times for the same day. This data is then used to calculate total working hours and identify anomalies, such as tardiness or early departures.

3.5.3. Leave request processing

The leave request algorithm streamlines the process of submitting and managing employee leave. Employees provide details like leave type, start and end dates, and reasons for leave. The algorithm checks the employee's leave balance and ensures there are no conflicts with existing schedules. Approved requests are forwarded to the manager for final validation. This process ensures that leave is managed efficiently while maintaining departmental productivity.

3.5.4. Leave approval by managers

The leave approval algorithm enables managers to review and act on leave requests. The system retrieves leave details, checks leave balances, and evaluates the department's workload before allowing managers to approve or reject the request. Once a decision is made, the system updates the leave status in the database and notifies the employee. This structured approach minimizes delays and ensures transparency in leave management.

3.5.5. Attendance reporting

The attendance reporting algorithm aggregates and analyzes attendance data for a specified period. Administrators can filter reports by date range, employees, or departments. The algorithm compiles data such as total working hours, absenteeism rates, and overtime, presenting it in detailed or summary formats. These reports assist in monitoring employee performance and identifying trends, aiding data-driven decision-making.

3.5.6 Anomaly detection

The anomaly detection algorithm identifies irregularities in attendance patterns, such as frequent late arrivals or unrecorded hours. By setting predefined thresholds, the system flags records that

deviate from norms. Notifications are sent to administrators for further investigation, allowing for timely corrective actions. This feature enhances the reliability and accountability of the system.

3.5.7 User interface design

Consists of elements such as the architecture, modules and components, the different interfaces of those components and the data that goes through that system. It is meant to satisfy specific needs and necessities of the system. Therefore, the Design and Implementation were thus presented using Unified Modeling Language (UML) diagrams. The various Unified Modelling Language (UML) diagrams used in show casing the designing and implementation of the proposed system included; Data flow diagram (DFD), Use Case Diagram, Entity Relation Diagrams (ERDs), Activity Diagram, Class Diagram and Sequence Diagram

3.5.7.2.1 Use Case Diagram

The use case diagram captures the functional requirements and interactions between the system and its users (actors). Each use case shows how a specific actor interacts with the system to achieve a goal.

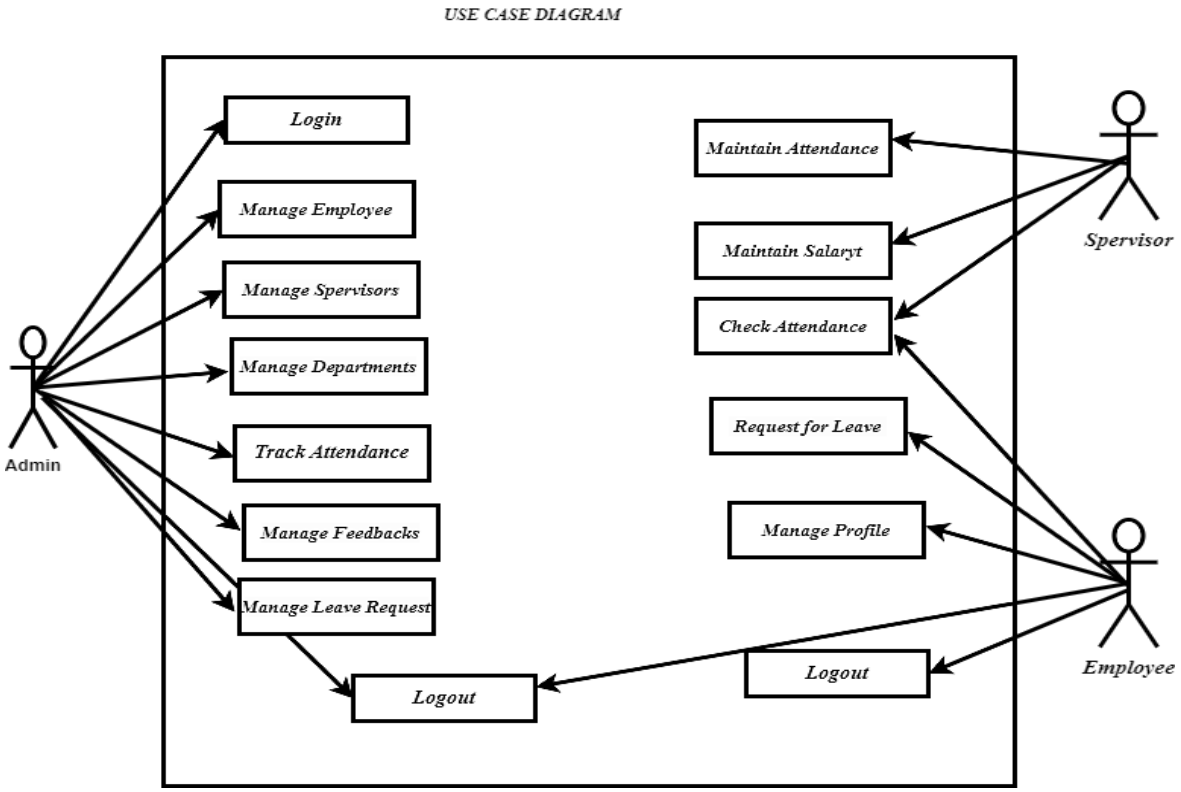


Figure 1: Showing use case diagram

3.5.7.2 Activity Diagram (Admin)

The diagram represents the flow of activities within a process, emphasizing workflows and decision points. When an employee "Apply for Leave" process begins with the employee logging into the system, navigating to the leave form, and submitting a request. The system then evaluates the request, leading to a decision point: whether the leave is approved or rejected. Depending on the outcome, the system updates the status and notifies the employee.

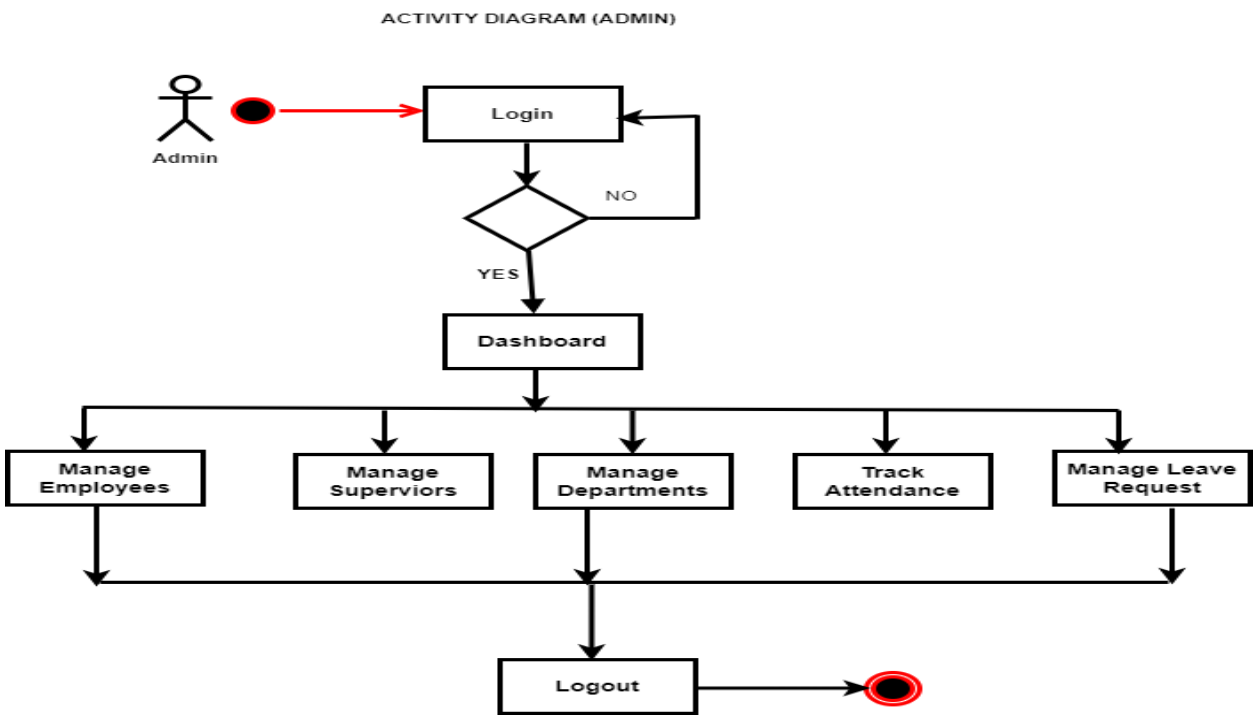


Figure 2: Admin's activity diagram

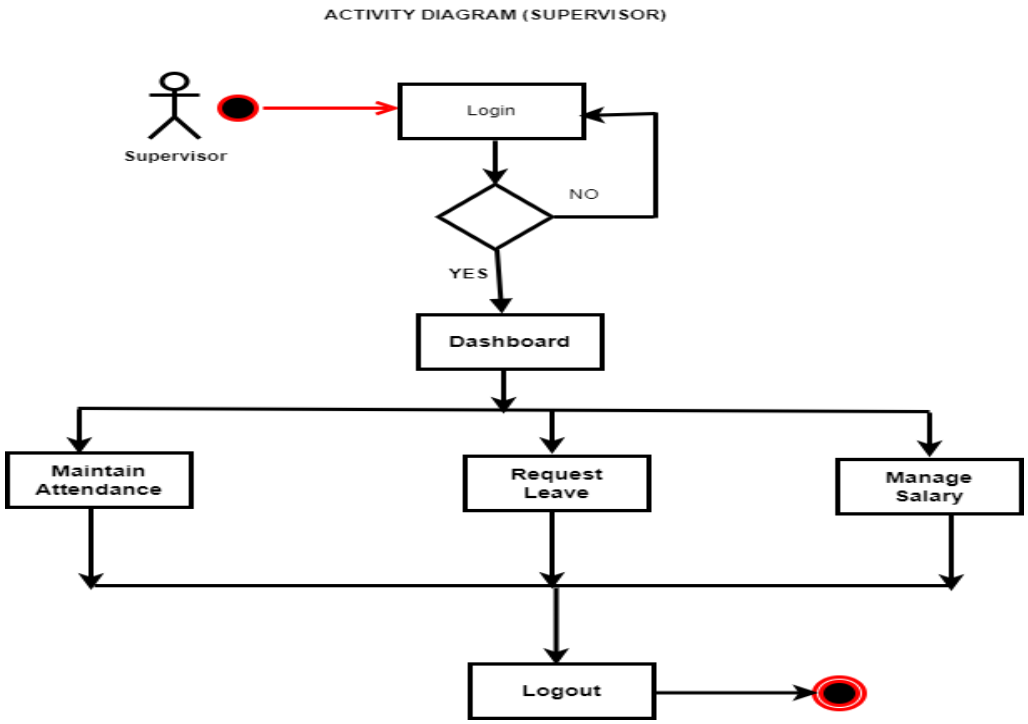


Figure 3: Showing supervisors' activity diagram

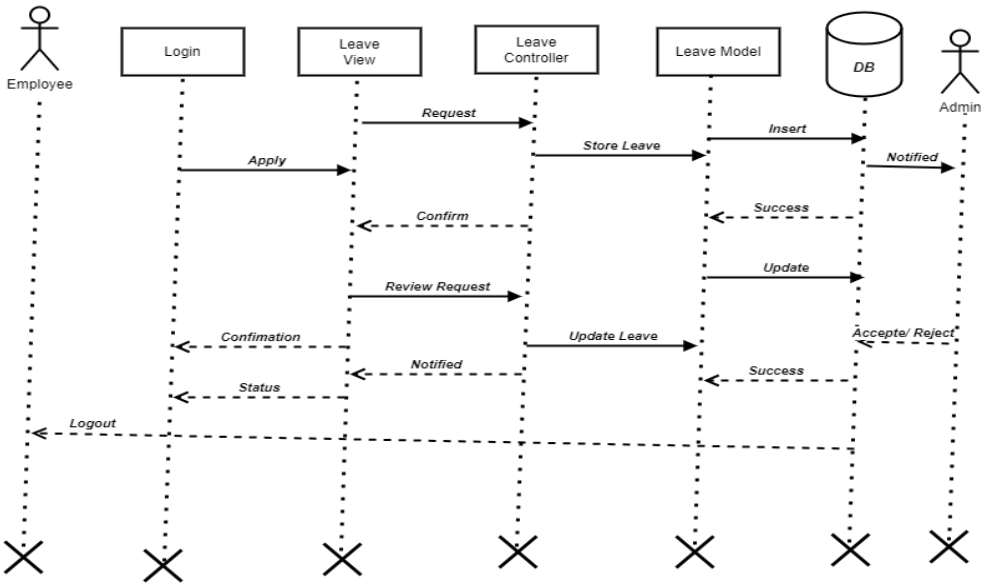


Figure 4: Showing employees' activity diagram

The sequence diagram models the dynamic interactions between objects in the system over time. For example, in the "Apply for Leave" process, the Employee interacts with the Leave Module to submit a leave request. The Leave Module then validates the request, updates the database, and notifies the Admin for approval. By detailing these steps in sequence, the diagram provides a clear view of how system components communicate to execute a specific functionality.

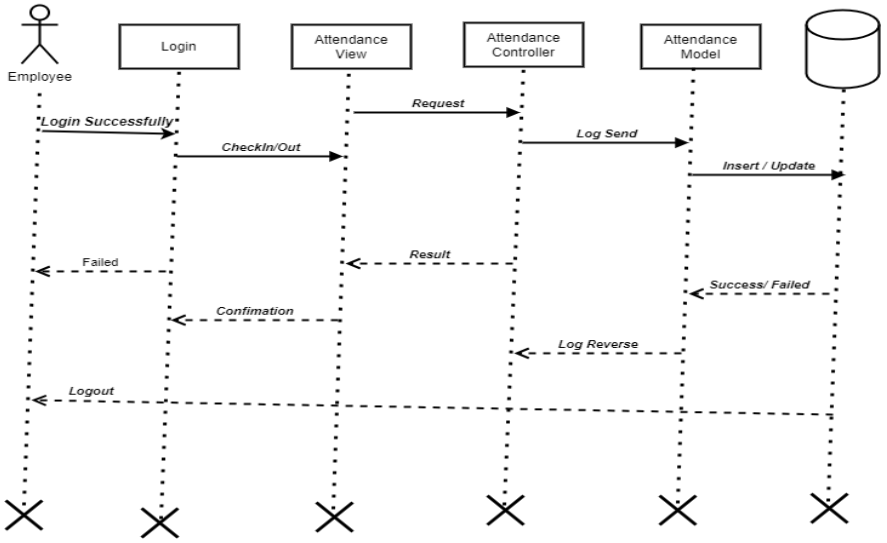


Figure 5: Showing employees' leave sequence diagram

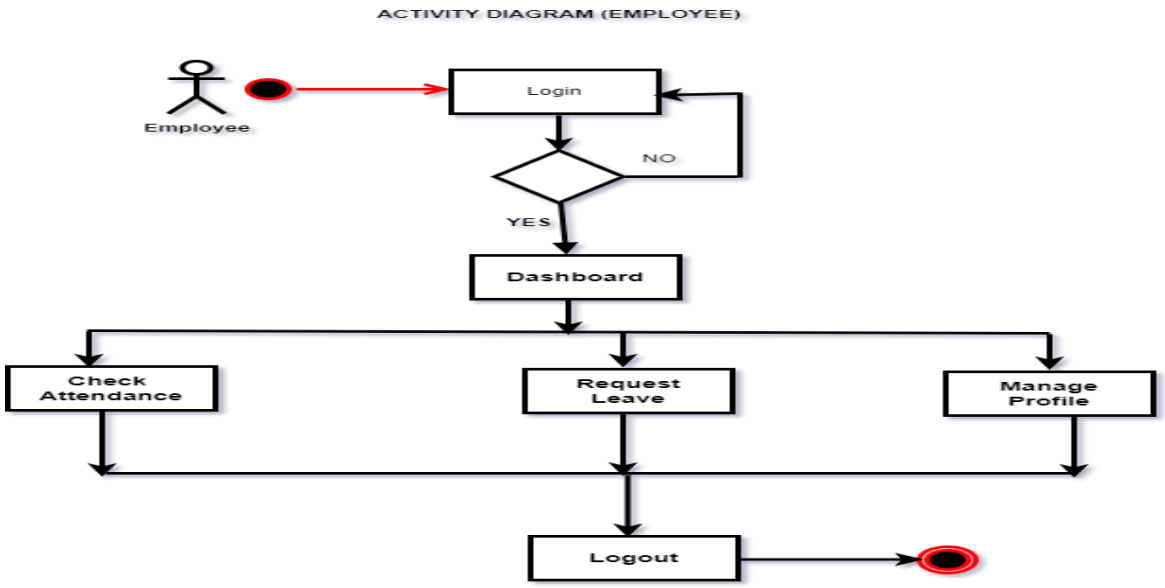


Figure 6: Showing employees' attendance sequence diagram

The diagram illustrates the static structure of the system, focusing on its classes, attributes, methods, and relationships. The diagram serves as a blueprint for system development, detailing the core components and their interactions.

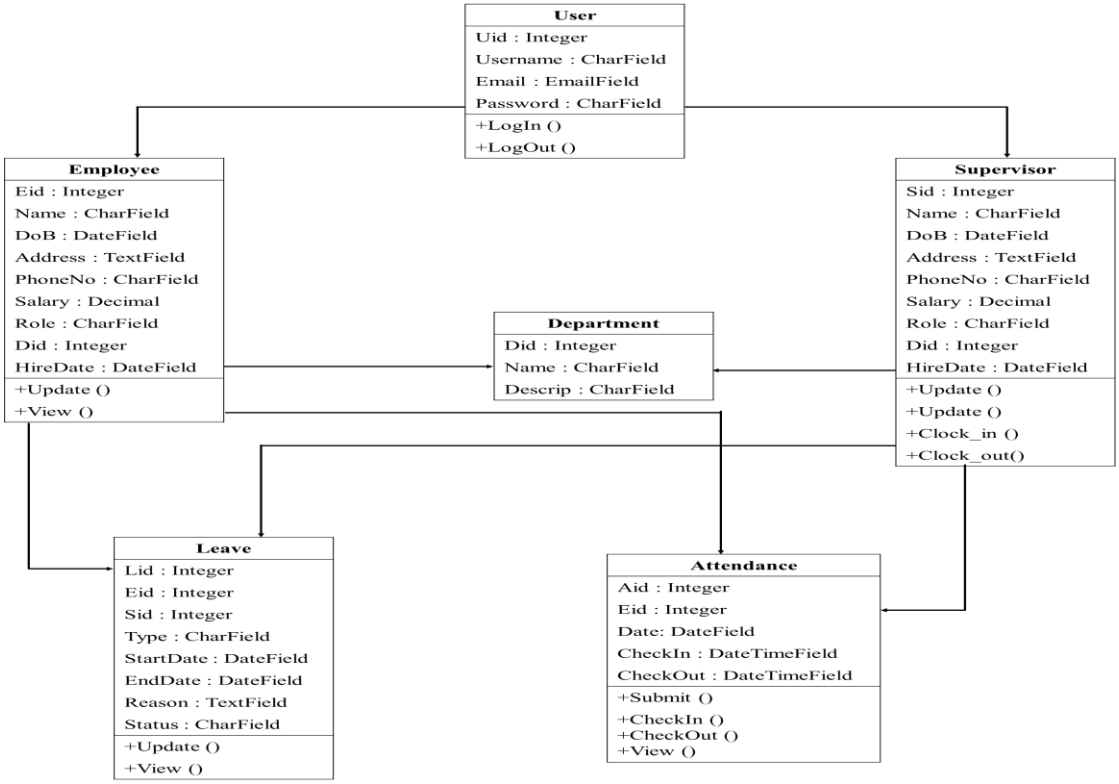


Figure 7: Showing the system's Class diagram

The data flow diagram shows how data moves through the system, from inputs to processes and outputs. At the highest level (Level 0), the diagram provides an overview of the system, showing major processes like "Manage Attendance" and "Handle Leave Requests." Subsequent levels break these down into finer details. For instance, Level 1 might detail how "Apply for Leave" accepts inputs like leave dates and employee IDs and outputs the leave status after processing. The DFD highlights how data, such as attendance records and leave applications, flows between system components and external entities like employees and admins.

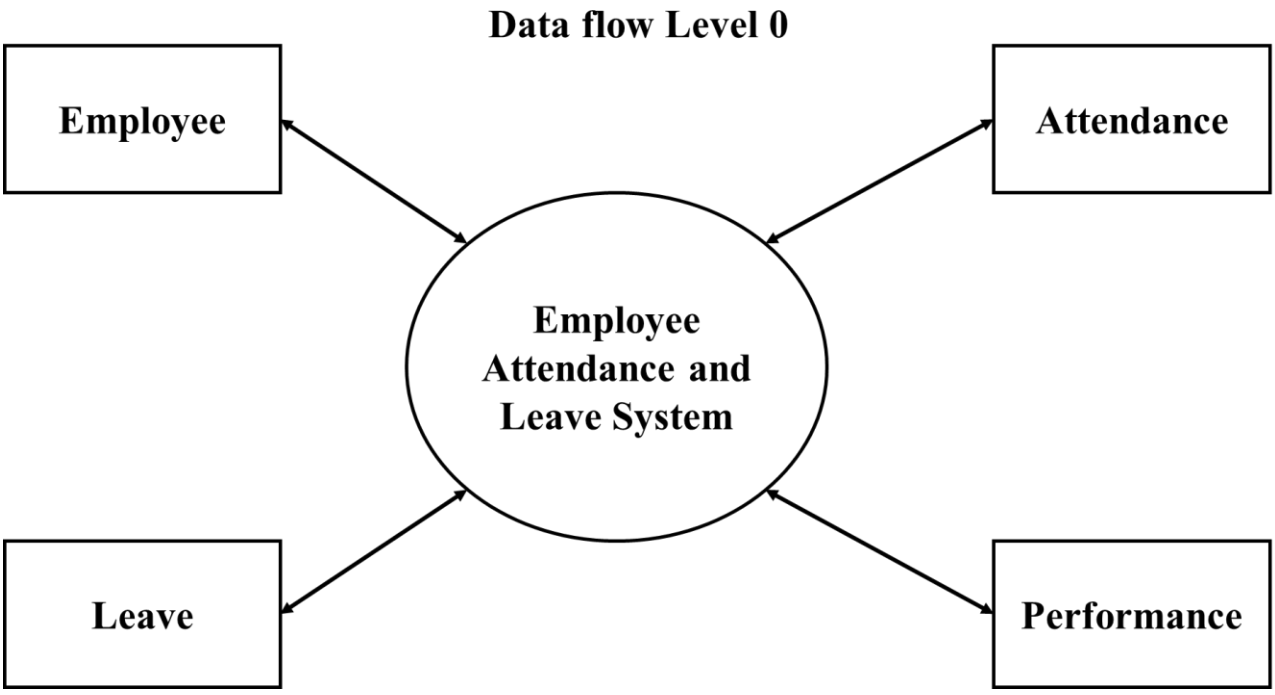


Figure 8: Showing the system's Dataflow diagram - level 0

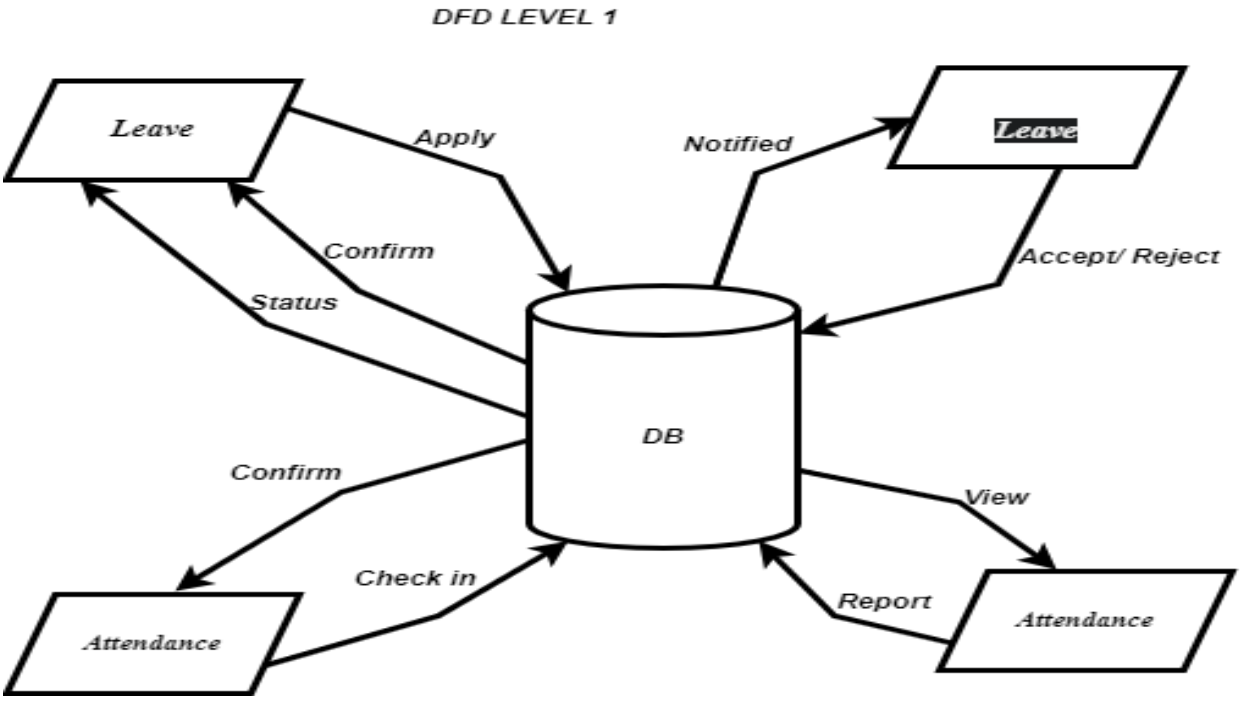


Figure 9: Showing the system's Dataflow diagram - level 1

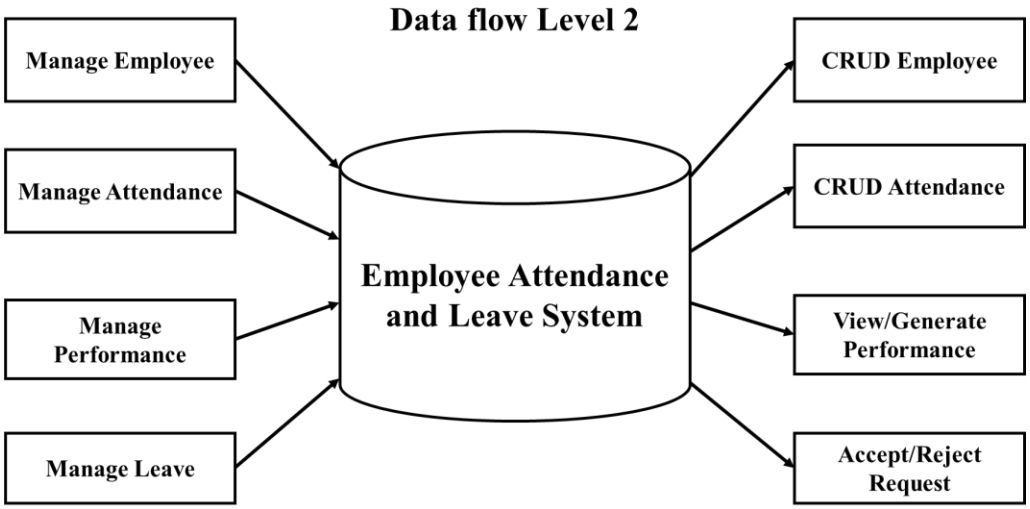


Figure 10: Showing the system's Dataflow diagram - level 2

3.6 DATABASE AND DATA MANAGEMENT MODELS

In this phase, the researchers focused on defining the data and constraints about the key entities, it involves identifying the entities, what data is stored about the entities and which fields about the entities are unique (primary keys) in designing the database for the Employees' Attendance and Leave Management system.

In designing the database, the researcher employs Django's Object-Relational Mapping (ORM) which maps Python classes to database tables, making it easy to design and interact with the SQLite database. The core models for the system include:

a. User Model

This model stores universal information about all users in the system.

Table 1: Showing user database table

		is_superuser	first_name	last_name	is_staff	is_active	date_joined	email	user_type	gender
		Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	29.549784	1	Mohamed Osman	Kamara	1	1	2024-09-22 12:08:08.826538	admin@admin.com	1	
2	28.157596	0	Mohamed Osman	Kamara	0	1	2024-09-22 13:28:38.139752	mokamara192@gmail.com	3	M
3	NULL	0	Employee	User	0	1	2024-09-22 22:30:24.064569	employee@employee.com	3	F
4	29.296117	0	supervisor	supervisor	0	1	2024-12-18 20:25:41.341835	supervisor1@gmail.com	2	M
5	28.164350	0	Employee	Employee	0	1	2024-12-18 20:29:19.676127	employee1@gmail.com	3	F

b. Admin Model

This model stores information about the admin.

Table 2: Showing Admin database table

f	is_active	date_joined	email	user_type	gender	profile_pic	address	fcm_token
	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	1	2024-09-22 12:08:08.826538	admin@admin.com	1		/media/user.png		
2	1	2024-09-22 13:28:38.139752	mokamara192@gmail.com	3	M	/media/user_9O5THIA.png	Makeni	
3	1	2024-09-22 22:30:24.064569	employee@employee.com	3	F	/media/user_MuoBgJU.png	Makeni	
4	1	2024-12-18 20:25:41.341835	supervisor1@gmail.com	2	M	/media/uml%20Diagram.jpg	Mile 91	
5	1	2024-12-18 20:29:19.676127	employee1@gmail.com	3	F	/media/favicon.png	Mile 91	

c. Supervisor Model

This model stores information about employees.

Table 3: Showing supervisor table

profile_pic	address	fcm_token	created_at	updated_at
Filter	Filter	Filter	Filter	Filter
/media/user.png			2024-09-22 12:08:11.129346	2024-09-22 20:56:28.977232
/media/user_9O5THIA.png	Makeni		2024-09-22 13:28:40.437356	2024-09-22 22:30:52.098493
/media/user_MuoBgJU.png	Makeni		2024-09-22 22:30:27.094252	2024-09-22 22:30:27.527875
/media/uml%20Diagram.jpg	Mile 91		2024-12-18 20:25:42.469315	2024-12-18 20:25:42.497279
/media/favicon.png	Mile 91		2024-12-18 20:29:20.585624	2024-12-18 20:29:20.610487

d. Employee Model

This model stores information about employees.

Table 4: Showing Employee table

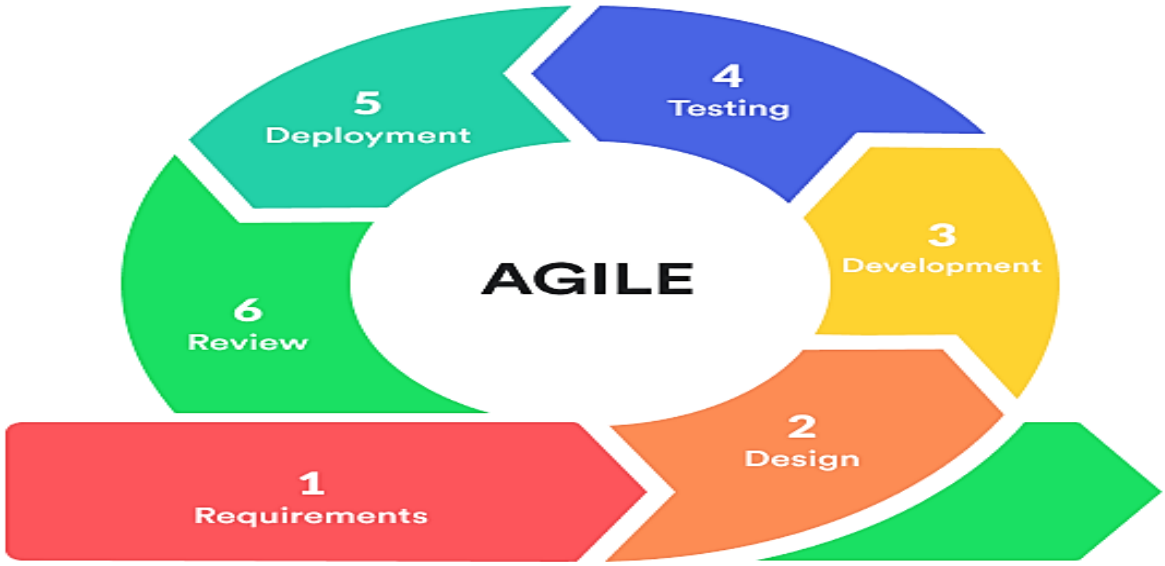
		is_superuser	first_name	last_name	is_staff	is_active	date_joined	email	user_type	gender
		Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	9.549784	1	Mohamed Osman	Kamara	1	1	2024-09-22 12:08:08.826538	admin@admin.com	1	
2	8.157596	0	Mohamed Osman	Kamara	0	1	2024-09-22 13:28:38.139752	mokamara192@gmail.com	3	M
3	NULL	0	Employee	User	0	1	2024-09-22 22:30:24.064569	employee@employee.com	3	F
4	9.296117	0	supervisor	supervisor	0	1	2024-12-18 20:25:41.341835	supervisor1@gmail.com	2	M
5	8.164350	0	Employee	Employee	0	1	2024-12-18 20:29:19.676127	employee1@gmail.com	3	F

3.7 SYSTEM DEVELOPMENT METHODOLOGY

For the development of the Employee Attendance and Leave Management System, the researcher chose the Agile methodology, widely recognized as one of the most effective approaches to systems development. Agile is well-suited for projects where requirements can evolve and where close collaboration between developers and end-users is essential.

The Agile methodology divides the development process into phases or iterations, which are short development cycles that allow teams to work on specific components of the system and deliver them to users quickly. This approach promotes constant communication and feedback between the development team and stakeholders, ensuring that the system aligns with the users' needs and requirements. With this iterative process, the system is continuously improved and refined, allowing users to experience partial versions of the system and provide input for adjustments, thereby making it easier to adapt to any changes or new requirements that arise during the development

As highlighted by Tindyebwa (2022), Agile encourages breaking the project into smaller segments, fostering constant teamwork with stakeholders, and ensuring continuous improvement throughout the planning, execution, and evaluation stages. This flexibility and constant feedback loop make Agile a crucial approach for effective project management and ensuring the system is developed in a way that meets user expectations and organizational goals.



Source: https://miro.medium.com/v2/resize:fit:1024/0*2BEeiYrLYNdrNoby.png

Figure 11: Showing Agile software methodology

Why used Agile Methodology

1. **Allows adapting to changing requirements:** Agile promotes a flexible approach to accommodate new user needs uncovered during development through iterative delivery and client feedback loops.
2. **Frequent stakeholder collaboration:** Continuous stakeholder involvement via reviews of incremental prototypes and demos enables alignment on dynamic needs.
3. **Prioritization of critical features:** Focused sprints for delivering core module functionalities early provides faster Return On Investment (ROI).
4. **Concurrent development and testing:** Parallel agile processes like continuous integration and test-driven development improve quality through rapid feedback cycles.

5. **Risk mitigation through iteration:** Regular inspection and adaptation cycles lower risk profiles compared to traditional long project timelines with single delivery milestones.
6. **Promotes transparency:** Daily standups, burn down charts, story point tracking allows teams and clients to regularly assess progress and flag issues.

3.7.1 System development model

The system was developed using the Agile development model, emphasizing flexibility, iterative progress, and collaboration to address evolving requirements and priorities effectively. In the Research/Planning phase, a prioritized backlog was created to outline the system's scope and objectives, with sprint planning meetings used to identify high-priority tasks. Collaborating with HR managers, employees, and stakeholders refined the project vision. Feasibility studies were conducted incrementally, focusing on technical, economic, and operational aspects, ensuring adaptability to constraints such as budget changes or resource limitations. During the System Analysis phase, user story mapping visualized system requirements, with regular feedback loops ensuring alignment with user expectations.

System Design was broken into manageable tasks, iteratively addressing database structure, user interface, security, and architecture, continuously improving based on feedback. Development and Testing were conducted in iterative cycles, employing continuous integration and automated testing to maintain functionality and promptly address issues. Maintenance followed a continuous delivery model, with new features deployed to staging environments and updates prioritized in the backlog. System Documentation was treated as a living document, updated alongside the system’s evolution to include user manuals and technical guides, ensuring relevance and utility for all users. This Agile-driven approach ensured a robust, user-focused, and adaptable system.

3.8 EXISTING ATTENDANCE AND LEAVE PROCESS

The current method used for Employee Attendance and Leave Management in many organizations is still largely manual, relying on paper based or spreadsheet systems to track employee attendance and manage leave requests. This traditional process involves employees marking their attendance on physical timesheets or manually submitting leave requests to their supervisors or HR departments. Supervisors then verify the information, approve or reject leave requests, and record attendance for payroll processing.

One of the advantages of this traditional approach is its simplicity and familiarity. Employees and managers are accustomed to manually recording attendance and submitting leave requests on paper, and it does not require significant investment in technology. Additionally, this system is perceived as secure due to the physical nature of the records, which may seem less prone to digital errors or cyber threats.

However, the manual process comes with significant drawbacks. The time and effort spent on manually tracking attendance and approving leave requests is both labor-intensive and error prone, which can lead to delays and inaccuracies in attendance records. Human errors in calculating leave balances or tracking absences can result in discrepancies, leading to frustration among employees and complications during payroll processing. Moreover, the physical handling of records can lead to loss, damage, or tampering of sensitive employee data, raising concerns about privacy and data integrity.

Despite these challenges, many organizations continue to rely on traditional methods of attendance and leave management due to their perceived reliability and familiarity. Efforts are being made in several organizations to modernize and digitize these processes by adopting automated systems that reduce the risks of errors, increase efficiency, and improve the accuracy of attendance tracking and leave management. These efforts aim to retain the strengths of the traditional system, such as transparency and security, while mitigating its inherent drawbacks.

3.9 PROPOSED SYSTEM OVERVIEW

The proposed system for Employee Attendance and Leave Management aims to modernize the traditional manual processes by incorporating advanced technologies that ensure accuracy, security, and efficiency. The system is designed to address the limitations of the current method and enhance several critical aspects:

Key Features:

Accessibility Features: In promoting inclusivity, the system will focus on improving accessibility for employees with disabilities. Design features will be implemented to ensure that the system can be navigated and used by employees with physical or visual impairments, eliminating barriers in engaging with the attendance and leave management process.

Transparency and Tamper Resistance: The system will incorporate advanced technological solutions to enhance transparency and immutability. By leveraging distributed ledger technology, the system will provide an audit trail of all actions related to attendance and leave approvals, making it more tamper resistant and verifiable.

Automated Notifications and Alerts: Automated notifications and alerts will be integrated to notify employees and supervisors about pending approvals, late check-ins, and leave requests, ensuring timely follow-ups and smoother operational workflows.

Real-time Reporting: The system will offer real-time reporting capabilities, allowing administrators and supervisors to track attendance, leave balances, and absences with up-to-date accuracy. This will help minimize delays in payroll processing and ensure timely updates of employee records.

Data Analytics and Performance Insights: The system will provide data analytics to help organizations analyze attendance patterns, absenteeism rates, and leave trends. These insights will guide decision making, improving workforce management and productivity.

By introducing these technologies, the proposed system aims to address the inefficiencies, security risks, and accessibility barriers associated with the current manual approach. It will transform

employee attendance and leave management into a more efficient, secure, and inclusive process while promoting fairness and transparency in tracking employee performance.

3.8.1 Functional requirements of the proposed system

The functional requirements of the proposed Employee Attendance and Leave Management System define the essential features and capabilities the system must offer to ensure it meets organizational needs efficiently. These requirements focus on the core functions and user needs, ensuring the system performs optimally under specific conditions. Below are the functional requirements for the system

1. Security and Authentication: One of the primary requirements of the system is robust security. The system must ensure that only authorized personnel can access and interact with the system. This will be achieved through a secured login system, including email and password combinations. Additionally, the system will employ role based access control to restrict access to sensitive information like leave balances or attendance records based on user roles (e.g., employee, HR manager, and supervisor).

2. Employee Privacy: To safeguard employee data, the system must implement strong encryption methods. This will ensure that the personal data of employees, including attendance records and leave requests, are protected from unauthorized access or tampering. The system should also allow employees to view their attendance and leave data without exposing sensitive details to unauthorized individuals.

3. Leave and Attendance Tracking: The system must accurately track employee attendance (e.g., clock-in and clock-out times) and leave requests (e.g., sick leave, vacation leave). The attendance tracking will be automated through face recognition and geolocation tagging. For leave requests, employees should be able to submit leave requests online, which will be processed and approved by the appropriate managers or HR personnel.

4. Automated Notifications and Alerts: The system should automatically notify employees and managers about attendance anomalies or pending leave requests. Employees should receive updates on the status of their leave requests, and HR managers should be notified about approvals, rejections, or changes in the status of leave requests.

5. Audit Trail and Transparency: The system must maintain an audit trail that logs all actions, including employee check-ins/outs, leave requests, approvals, and any changes made to the system. This feature will help ensure transparency and accountability by allowing managers and HR personnel to trace any discrepancies or issues. The audit trail will also be accessible for review, providing transparency in attendance and leave management.

6. Reporting and Analytics: The system should provide real-time reports that allow HR personnel and managers to track attendance trends, employee leave balances, and absenteeism patterns. Reports should be customizable, allowing for detailed insights into employee performance, departmental attendance, and overall workforce productivity. The system should also be capable of generating monthly or yearly reports for payroll processing and performance evaluations.

8. Ease of Use: The system must be user-friendly and intuitive. Employees should be able to easily clock in/out, submit leave requests, and view their attendance records with minimal training. HR managers and administrators should have a simple interface for approving leave requests, reviewing attendance reports, and managing employee records. The system should include clear instructions, help guides, and customer support options for users needing assistance.

9. System Integration: The proposed system should be capable of integrating with other organizational tools like payroll systems and HR management software. This integration will streamline processes such as payroll calculations, performance reviews, and leave accrual tracking, ensuring a seamless workflow across various departments.

These functional requirements aim to ensure that the Employee Attendance and Leave Management System not only simplifies the tracking process but also enhances security, transparency, and user accessibility, making it an essential tool for modern workforce management.

3.8.2 Non-functional requirements of the system

Nonfunctional requirements define how the Employee Attendance and Leave Management System should perform under certain conditions, emphasizing aspects such as system behavior, performance, and usability rather than specific functions. These requirements ensure the system

meets user expectations in terms of its quality, reliability, and operational efficiency. Below are the nonfunctional requirements for the system:

Accuracy: The system must ensure the accuracy of attendance tracking, leave balances, and employee data. This is especially critical in validating employee clock-ins/outs and leave requests. Accurate facial recognition and geolocation data will be used to ensure that the attendance logs are correct. Additionally, the system should handle potential validation errors and automatically rectify inaccuracies through periodic checks and database synchronization, thus minimizing discrepancies.

Usability: The system will be designed with a focus on user-friendliness. Both employees (voters) and administrators (HR staff) will be able to navigate the system with ease. The interface will be simple and intuitive, with minimal need for extensive manuals or training. Features like self-service attendance tracking and leave request management should be easy to understand, ensuring all users can access, use, and interact with the system quickly and efficiently.

Reliability: The system must operate reliably without frequent crashes or unexpected behavior. Attendance tracking should remain uninterrupted, with the system continuously recording employee actions accurately. Fail safes will be in place to ensure data is correctly logged, and when discrepancies occur, the system will allow for the confirmation or correction of data, minimizing operational disruption. Regular system backups and data recovery mechanisms will ensure reliability in case of system failures.

Security: Security is paramount in protecting sensitive employee data, especially login information. The system will implement multilayered security measures, including role based access control (RBAC), encrypted communication, and secure login mechanisms will be used to verify employees at clock-in and clock-out times, and only authorized users will have access to sensitive data. Any unauthorized attempts to access the system will be promptly flagged and blocked, ensuring data confidentiality and user privacy.

Performance: The system must be highly responsive, with fast load times and quick user interactions. The system should load information, such as attendance records and leave balances, in no more than ten seconds. User actions, such as submitting a leave request or clocking in, should

not have delays exceeding ten seconds. This ensures that employees and administrators experience minimal wait times and that the system remains efficient, even under heavy usage or multiple concurrent users.

These nonfunctional requirements focus on optimizing the Employee Attendance and Leave Management System for everyday use while ensuring it meets performance standards and operational expectations in various conditions.

3.9 FEASIBILITY ANALYSIS

Feasibility analysis is a crucial step in developing an Employee Attendance and Leave Management System as it helps identify risks, challenges, and the overall viability of the system. This analysis covers the technical, economic, and operational aspects of the system to ensure it meets organizational goals and can be implemented successfully.

3.9.1 Technical feasibility

The technical feasibility of the employee attendance and leave management system focuses on the architecture and technologies used in the development. The system is designed as a web based application, utilizing Django (Python framework) for the frontend interface and connecting it to the backend database using SQLite for efficient data storage and retrieval. The use of Django ensures a secure and scalable platform for managing employee attendance and leave requests, providing real-time updates and easy access to records.

This technical setup ensures reliable performance, allowing the system to efficiently handle employee data, attendance records, leave requests, and approval processes. With robust backend functionality and a user-friendly frontend, the system is designed to meet the technical requirements of any organization looking to streamline its attendance and leave management.

3.9.2 Economic feasibility

Economic feasibility analyzes the financial impact of the system and how the investment compares to the savings and benefits in the long term. While the initial setup cost for developing and deploying the online attendance and leave system may range between $200,000 to $250,000 (for servers, licensing, infrastructure, and custom development), it offers significant cost savings in comparison to traditional manual attendance systems (Peterson, Thompson, & Williams, 2021).

Manual attendance systems require physical paperwork, manual recordkeeping, and employee verification, all of which incur significant costs. Additionally, personnel are required to monitor attendance and manage leave requests, which adds to operational expenses. The online system reduces these overheads by automating the attendance tracking, approval processes, and reporting.

A cost benefit analysis reveals that the online system will save more than $75,000 annually by eliminating the need for paper based records, reducing manual efforts, and improving productivity through automated leave approvals and tracking. Over time, the system will pay for itself within a few cycles, providing a solid return on investment.

Moreover, as the system becomes widely adopted, it can also be licensed to other organizations, providing additional revenue streams.

3.9.3 Operational feasibility

The operational feasibility of the system involves evaluating its likelihood of success in terms of user adoption and integration with existing operations. While some users may not be immediately familiar with an online attendance system, the user-friendly design of the platform ensures that employees and administrators can easily navigate and interact with the system. The intuitive interface minimizes the learning curve for both employees and administrators.

Given the high IT literacy of most employees, the system is designed to be accessible with minimal training. To ensure smooth integration, training sessions will be provided to familiarize users with the new system and its features, such as logging attendance, submitting leave requests, and managing approval

User roles and access levels in the system are as follows:

1. System Administrator:

- Responsibilities:
  - ✓ Managing employee attendance records.
  - ✓ Configuring and setting up leave policies.
  - ✓ Monitoring attendance and leave requests.
  - ✓ Addressing issues related to the system.
- Access Level:

- ✓ Full access to configure and manage the entire system.

2. Supervisors:

- ➢ Responsibilities:
  - ✓ Logging attendance via manual entry.
  - ✓ Submitting leave requests.
  - ✓ Marking attendance records of employees.
  - ✓ Assessing the workforce productivity of employees.
- ➢ Access Level:
  - ✓ Limited to managing the attendance of their departments.

3. Employees:

- ➢ Responsibilities:
  - ✓ Logging attendance via manual entry.
  - ✓ Submitting leave requests.
  - ✓ Viewing attendance records and leave balances.
- ➢ Access Level:
  - ✓ Limited to managing their attendance and leave requests.

In conclusion, the Employee Attendance and Leave Management System is technically feasible, as it uses proven technologies (Django and SQLite) to ensure scalability and security. The system is also economically viable, offering long-term savings on manual labor and paper based processes. Additionally, it is operationally feasible, with an intuitive design that aligns with the technological literacy of employees, ensuring ease of use and smooth adoption within the organization.

3.10 SCALABILITY AND PERFORMANCE OPTIMIZATION

As the system grows in terms of users, data, and functionality, ensuring scalability and optimizing performance are essential to maintain system efficiency and reliability. The following explains the key approaches for scalability and performance optimization.

3.10.1 Database scalability

Scaling the database is critical for handling a growing volume of employee records, attendance logs, and leave data. Horizontal scaling can be achieved by replicating the database to handle read-heavy operations, distributing query loads across multiple servers. Additionally, data sharing by departments or regions allows the division of data into smaller, more manageable chunks across different databases. Vertical scaling, which involves upgrading database resources such as CPU and memory, is another strategy for increasing capacity.

For efficient data management, the system can be migrated for SQLite to PostgreSQL, MySQL, and Oracle or other cloud storage platforms like: AWS, Azure, or Google Cloud for concurrent and distributed data management.

3.10.2 Application scaling

The application should scale seamlessly to accommodate an increasing number of users, including HR managers, supervisors, and employees. Load balancers can distribute user traffic across multiple servers, preventing any single server from becoming a bottleneck. The system can also be deployed in a containerized environment using tools like Docker and Kubernetes, which simplify the process of adding new instances as demand increases.

For asynchronous operations like generating reports or sending notifications, queue-based systems such as Celery with Redis can offload these tasks, ensuring that the system remains responsive for real-time operations.

3.10.3 Performance optimization

To enhance performance, query optimization is essential. Using Django's select_related and prefetch_related methods ensure efficient data retrieval by reducing the number of database hits when fetching related records. For instance, retrieving employee details and their attendance logs can be done in a single query, minimizing latency.

Frontend performance can be improved by compressing static assets like CSS, JavaScript, and images to reduce page load times. Leveraging Content Delivery Networks (CDNs) ensures these assets are served quickly from servers geographically closer to users. Pagination of large datasets, such as attendance records, prevents overwhelming the system and improves response times.

3.10.4 Efficient data management

As data grows, efficient storage and retrieval become vital. Archiving old attendance and leave records reduces the active database's size, maintaining its performance. Archived data can be stored separately and retrieved when necessary. Implementing log management tools helps control the size of application logs, ensuring they don’t consume excessive storage or processing resources.

3.10.5 Monitoring and Reliability

Monitoring tools such as New Relic or Django Debug Toolbar allow real-time tracking of system performance and help identify bottlenecks. Redundancy is crucial for reliability, including using backup servers and databases to prevent downtime during failures. Automated database backups ensure data is secure and recoverable in case of corruption or accidental deletion.

3.10.6 User growth and workflow

As the system scales to support more users, it must handle increased concurrent logins, larger datasets, and higher transactional loads. For example, during peak hours when employees log attendance or request leaves, the system can deploy additional server instances to manage the load. This ensures that the system remains responsive without interruptions.

3.11 SECURITY DESIGN

The system’s security design focuses on protecting sensitive employee information and ensuring the system remains reliable and safe from unauthorized access. Here's how the system is secured:

1. Authentication and Authorization

The system ensures that only authorized users can access specific features. There are three types of users: HR managers, supervisors, and employees. Each user has permissions based on their role. For example, HR managers can access and manage all records, while employees can only view or update their own data. To make login more secure, the system uses methods like passwords combined with an additional layer of protection, such as a code sent to the user’s phone or email.

2. Data Protection through Encryption

Sensitive data like attendance records and leave applications are encrypted to keep them safe. Encryption is used both when data is stored in the database and when it is sent over the internet. This ensures that even if someone intercepts the data, they won't be able to understand it.

3. Protection from Common Threats

The system is designed to block common hacking techniques:

- It validates all user inputs to prevent malicious code or commands from being entered.
- It uses built-in tools to stop attackers from injecting harmful scripts or accessing restricted parts of the system.
- It ensures that requests sent to the system are from authorized users using special tokens for extra security.

4. Logging and Monitoring

To keep track of activities within the system, it records important actions, like logging in, applying for leave, or updating records. If unusual activity happens, such as multiple failed login attempts, the system can alert administrators to investigate.

5. Secure Communication

When the system connects with other applications or mobile devices, it uses secure methods to ensure that data isn't intercepted or misused. Each interaction is authenticated with special codes, and the number of requests to the system is limited to avoid overloading it.

6. Backups and Recovery

To avoid data loss, the system automatically backs up its data regularly. If something goes wrong, like a system crash or cyberattack, these backups can quickly restore all the information. This ensures that the system can recover without losing valuable records.

3.12 ETHICAL CONSIDERATIONS

Implementing an **Employee Attendance and Leave Management System** raises several ethical considerations that organizations must address to ensure fairness, respect for employee rights, and compliance with legal standards. Below are key ethical aspects to consider:

1. Privacy of Employee Data

One of the most critical ethical considerations is protecting the privacy of employee data. The system collects sensitive information such as attendance records, and leave history. Organizations must ensure that this data is stored securely and accessed only by authorized personnel. Employees should be informed about what data is collected, how it is used, and their rights regarding access and deletion of their personal information.

2. Transparency and Consent

It is essential to maintain transparency about the system's functionality and the policies governing attendance and leave management. Employees should be aware of the methods used to track attendance, and consent to their use. Transparent communication fosters trust and prevents feelings of surveillance or unfair treatment.

3. Fairness and Equity

The system is designed and implemented to treat all employees fairly and equitably. For example, leave approvals follow consistent rules without favoritism or discrimination. Special accommodations, such as flexible work arrangements for employees with disabilities or personal challenges, should be incorporated into the system to ensure inclusivity.

4. Work-Life Balance

Ethically, organizations have a responsibility to support employees' work-life balance. The system is designed not to discourage employees from taking leave when needed. For instance, metrics on absenteeism are not create undue pressure or stigmatize employees who utilize their entitled leave. Instead, the system promotes healthy leave practices and accommodate personal and family needs.

5. Accessibility and Inclusivity

The system is accessible to all employees, including those with disabilities or limited technical proficiency. For example, interfaces are user-friendly and compatible with assistive technologies. By addressing these needs, the researcher demonstrates a commitment to ethical inclusivity.

6. Compliance with Labor Laws

Organizations must ensure the system aligns with local labor laws and regulations. This includes adhering to statutory leave entitlements, fair attendance policies, and non-discriminatory practices. Ethical compliance minimizes legal risks and upholds employee rights.

7. Monitoring and Surveillance

While tracking attendance is necessary, excessive monitoring can lead to ethical concerns about workplace surveillance. Organizations should avoid using the system to micromanage or monitor employees excessively, as this can erode trust and morale. The focus should remain on improving operational efficiency rather than policing behavior.

3.13 LIMITATIONS

While the system is designed to streamline attendance tracking and leave management processes, certain limitations arise due to the absence of advanced technologies like biometric authentication and geographical data tracking. These limitations can affect the system's efficiency, accuracy, and overall effectiveness in specific scenarios. Below are some key limitations:

1. Lack of Biometric Verification

The system does not utilize biometric data, such as fingerprints or facial recognition, for attendance tracking. This limitation can lead to challenges in accurately verifying employee attendance. Without biometric authentication, the system relies on manual or less secure methods such as user IDs or passwords.

2. Absence of Geographical Tracking

The system does not incorporate geographical data tracking, such as GPS, to monitor the physical location of employees. As a result, it is less effective for managing remote or field-based

employees who work outside the office premises. The inability to confirm whether an employee is at a designated location during work hours can limit the system's applicability in industries where location verification is critical, such as logistics, sales, or on-site service roles.

3. Potential for Inaccurate Data

In the absence of advanced tracking mechanisms, the system depends heavily on employee self-reporting and manual inputs, which can lead to data inaccuracies. This limitation may require additional oversight from supervisors or HR personnel to verify and correct discrepancies.

4. Limited Enforcement of Work Policies

Geographical data can be instrumental in enforcing specific work policies, such as ensuring employees adhere to designated work locations or schedules. Without this feature, the system cannot enforce policies related to location-based attendance, which might be critical for roles requiring employees to be present at particular sites or areas.

5. Increased Administrative Burden

Due to the system's reliance on manual inputs and verification processes, HR managers and supervisors may face an increased administrative workload to validate attendance records and resolve discrepancies. This can reduce the time available for other strategic HR activities.

CHAPTER FOUR

4.1 IMPLEMENTATION, TESTING, MAINTENANCE AND RESULT

The successful implementation of a new system design is pivotal to achieving the intended benefits of the system. By following a structured process, engaging stakeholders, and addressing challenges proactively, organizations can ensure a smooth transition to the new system and maximize its value. The proposed system serves as an essential tool for modern organizations to manage employee attendance and leave in a structured and automated manner. This system ensures operational efficiency, enhances employee satisfaction, and supports compliance with labor laws.

4.2 SYSTEM EXPLORATION AND INSTALLATION

As the researcher and developer, my role in system exploration and installation involves ensuring the Employee Attendance and Leave Management System aligns with organizational needs while delivering a seamless implementation experience. In the exploration phase, I engage with stakeholders like HR managers, supervisors, and employees to understand their challenges and expectations. This feedback informs the system's design, ensuring essential functionalities like attendance tracking, leave management, and role-based access control are practical and user-friendly. I develop a prototype to visualize workflows, explore customizations for unique organizational policies, and integrate the system with existing tools like payroll systems. Additionally, I evaluate scalability to accommodate future growth, ensuring the system can handle increased users, departments, and data volumes.

The installation phase begins with setting up the technical infrastructure using Django for the backend, SQLite for the database, and a user-friendly interface, deployed in a controlled environment. Role-based access control is configured, and extensive testing ensures the system's functionality, including attendance logging, leave application, and report generation. Following this, user training and rollout are prioritized through interactive sessions, user manuals, and a phased deployment strategy to minimize disruptions and gather feedback. Post-installation, I focus on monitoring, providing updates, addressing user feedback, and maintaining open communication channels for support. This comprehensive approach ensures the system meets organizational goals, enhances user satisfaction, and provides a robust foundation for scalability and continuous improvement.

4.3 SYSTEM TESTING AND SPECIFICATION

Effective system testing and clear specifications are critical for ensuring the Employee Attendance and Leave Management System operates seamlessly. The testing process includes strategies for both the frontend and backend components, ensuring the entire system meets functional and non-functional requirements.

4.3.1 Frontend testing strategies

Frontend testing focuses on verifying the user interface and its interaction with the backend system. It ensures the application is user-friendly, functional, and free from errors.

1. **Unit Testing:** Each component of the frontend, such as the login form, attendance submission page, and leave application interface, was tested individually. For example, the login form was tested to verify input validation for username and password fields and error handling for invalid credentials.

2. **Functional Testing:** Functional testing validated that the frontend components work as expected. This included checking user workflows like submitting attendance, applying for leave, and viewing approvals. Each action was tested to ensure it performed the desired function correctly and provided appropriate feedback to the user.

3. **Integration Testing:** Integration testing examined the interaction between the frontend and backend. For instance, the system was tested to confirm that when an employee submits an attendance log, the data is accurately sent to and stored in the database. Similarly, the leave application interface was tested to ensure the backend received and processed requests correctly.

4.3.2 Backend testing strategies

Backend testing ensured that the database and server-side logic were functioning correctly, efficiently handling data storage, retrieval, and processing.

1. **Schema Testing:** The database schema was thoroughly tested to confirm that tables, relationships, and constraints were correctly implemented. For example, the "employees" table was checked for proper foreign key constraints linking it to the "departments" table.

2. **Table and Column Testing:** Each table and its columns were validated to ensure they met the required structure and constraints. For instance, the "attendance" table was checked for the presence of required fields like employee_id, check_in_time, and check_out_time. Constraints like NOT NULL and DEFAULT values were verified to avoid data inconsistencies.

3. **Stored Procedure Testing:** Stored procedures and functions, such as those calculating total hours worked or managing leave balances, were tested with various input scenarios. The goal was to confirm they executed correctly and returned accurate results. Edge cases, such as an employee applying for leave without sufficient balance, were included in the tests.

4.4 SYSTEM SPECIFICATION

The Employee Attendance and Leave Management System has been designed and developed with precise specifications to ensure functionality, efficiency, and scalability. These specifications define the framework and components that collectively enable the system to meet organizational requirements while delivering an optimal user experience.

4.4.1 Frontend specification

The system’s frontend is built using modern web technologies integrated with django templates. This ensures a dynamic and interactive interface for users. The design is responsive, allowing employees, supervisors, and HR managers to access the system seamlessly across various devices, including desktops, tablets, and smartphones. Form validations are implemented to prevent invalid data entry and ensure data consistency. For instance, attendance submission and leave application forms provide real-time feedback on incomplete or incorrectly formatted fields. These features ensure that users interact with a reliable and user-friendly interface.

4.4.2 Backend specification

The backend of the system is developed using Django, a robust web framework that facilitates seamless integration between the frontend and the SQLite database. The system is structured around a relational database schema, which includes normalized tables for employees, attendance logs, leave records, and departments. This structure ensures data consistency, reduces redundancy, and allows efficient data retrieval. Stored procedures and functions have been implemented to handle critical operations such as calculating total hours worked, managing leave balances, and generating reports. These backend features enable the system to efficiently manage large volumes of data while maintaining accuracy.

4.4.3 Performance and Scalability

The system is optimized for performance, with most operations completing within two seconds, even under significant user load. This optimization is achieved through efficient query handling, database indexing, and asynchronous operations where applicable. Scalability has been considered during development to ensure the system can handle an increasing number of users and data records as the organization grows. For example, the database can be migrated to more powerful relational database systems like PostgreSQL or MySQL if required.

4.4.4 Security

Security is a critical aspect of the system specification. Role-based access controls ensure that different user roles, including HR managers, supervisors, and employees, have access only to the data and functions relevant to their responsibilities. Sensitive information, such as passwords, is encrypted using industry-standard algorithms before storage. Additionally, the system incorporates measures to prevent unauthorized access and ensure data integrity, including session management and protection against SQL injection attacks.

4.5 SYSTEM PERFORMANCE TEST AND USER TRAINING ACTIVITIES

The performance testing of the Employee Attendance and Leave Management System ensures it operates efficiently under different conditions. Tests such as load and stress testing are conducted to evaluate the system’s ability to handle concurrent users and extreme usage scenarios without crashing or slowing down. Scalability testing confirms the system’s architecture supports future

organizational growth, while response time testing ensures critical operations, like logging attendance or applying for leave, are completed promptly. Additionally, reliability testing is performed to assess the system's stability during prolonged usage, ensuring consistent performance without errors.

Comprehensive user training activities are designed to help employees, supervisors, and HR managers adapt to the new system seamlessly. Employees are trained on basic functionalities like attendance logging and leave application, while supervisors learn how to approve requests, monitor attendance, and generate reports. HR managers receive advanced training on configuring policies, generating analytics, and managing system roles. Support materials, including user manuals and tutorials, complement training sessions to provide ongoing assistance.

Together, system performance testing and user training are essential to ensure the system meets organizational needs while empowering users to maximize its benefits effectively. These steps foster confidence, minimize disruptions, and pave the way for smooth system adoption.

4.6 SYSTEM SECURITY AND MAINTENANCE

The security and maintenance of the Employee Attendance and Leave Management System are critical to ensuring the safety of sensitive organizational data and the continuous, reliable operation of the system. Security measures include implementing role-based access controls to restrict data and functionality access based on user roles (e.g., HR managers, supervisors, employees). Data encryption ensures that sensitive information, such as employee details and leave records, is stored securely and transmitted safely over networks. Additionally, secure authentication mechanisms, such as strong password policies and optional two-factor authentication, protect against unauthorized access. Regular security audits are conducted to identify and resolve vulnerabilities, maintaining system integrity.

System maintenance focuses on ensuring the platform remains operational and updated. This includes routine server monitoring to detect performance bottlenecks and performing regular backups to prevent data loss in case of unexpected failures. Software updates are applied to address bugs, enhance functionality, and patch any security vulnerabilities. Periodic database optimization is carried out to ensure fast and efficient data retrieval as the system scales with organizational growth.

User feedback is actively collected to address usability issues and improve overall performance. A well-maintained support structure, including a helpdesk or dedicated IT team, ensures timely resolution of any system issues or user queries. By prioritizing security and maintenance, the system remains robust, efficient, and secure, supporting the organization's attendance and leave management needs effectively.

CHAPTER FIVE
RESULTS, RECOMMENDATION AND CONCLUSION

5.1 SUMMARY OF KEY FINDING OF THE RESULT

The Development and implementation of the Employee Attendance and Leave Management System (EALMS) has played a crucial role in improving how organizations manage attendance and leave. This project focused on making these processes easier and more efficient. EALMS was developed with three key user roles in mind: HR managers, supervisors, and employees. Each group has different access rights and functions tailored to their needs.

The development employed Django for the web framework and SQLite as the database, emphasizing a design centered on user-friendliness, operational efficiency, and robust security measures. The system includes important features such as role-based access control, which ensures that users only see information relevant to their roles. Employees can submit leave requests, while supervisors can approve or deny them. Attendance tracking allows organizations to keep precise records, and notifications keep users informed about their requests and approvals. Security is a top priority in the system's design. Various encryption methods are used to protect sensitive data. Strong authentication practices ensure that only authorized users gain access. Regular security audits are carried out to identify and fix any vulnerabilities.

Scalability is another major consideration built into EALMS. The system is designed to accommodate a growing number of users and data as the organization expands. This adaptability ensures that as a company adds more employees, the attendance and leave management processes remain efficient and effective.

Data analysis features allow for the examination of attendance and leave trends over time. These insights are valuable for managers making decisions about staffing and resource allocation. Overall, EALMS offers a more effective and reliable approach compared to traditional manual methods. By eliminating many of the common errors and reducing the workload for administrators, the system makes managing attendance and leave significantly simpler for everyone involved.

5.2 LESSONS LEARNED

The development process taught several valuable lessons that can inform future projects:

1. Importance of Clear Requirements: One of the most significant lessons learned during the development was the importance of gathering clear, detailed requirements from all stakeholders at the beginning of the project. Misunderstandings in the early stages can lead to scope changes later in the development cycle, which may cause delays or require rework. Regular feedback and communication with users were crucial in refining the system's functionalities and addressing emerging needs.

2. Role of Testing: A thorough testing process is essential to ensure that all system components function as intended. Both frontend (unit tests, functional tests, integration tests) and backend tests (schema, table, column, and stored procedure tests) helped identify and fix issues before deployment. System testing, including performance and security testing, also proved to be indispensable in ensuring the system's robustness and reliability.

3. Scalability Challenges: While scalability was considered from the start, it became clear that accommodating a growing user base and increasing data volume presents unique challenges. Proper database indexing and optimization techniques were vital to maintaining system performance as the amount of data grew.

4. Security and Data Privacy: Ensuring the security of sensitive data, such as employee attendance and leave records, was a high priority throughout the development. Data encryption, secure authentication, and regular security audits were critical to preventing unauthorized access and maintaining data privacy. This was particularly important given the sensitive nature of employee information.

5. User Training and Support: Proper user training is essential for the successful adoption of any system. During the development process, it became evident that providing easy-to-understand training materials and support channels would be necessary for users, especially HR managers and employees, to navigate the system effectively.

5.3 RECOMMENDATIONS

1. Regular System Updates and Maintenance: To ensure the system remains effective and secure, it is recommended to implement a regular schedule for software updates and maintenance. This will address potential security vulnerabilities, improve system performance, and introduce new features as required by the users. Maintenance should also include periodic backups and database optimization to prevent data loss and ensure smooth system operation.

2. Implement Biometric or Geographical Tracking Features: Although the system does not currently use biometric data or geographical tracking, integrating these features could improve attendance accuracy and prevent fraudulent activity. Biometric systems, such as fingerprint or facial recognition, can ensure that only the correct employee is logging attendance. Geographical tracking can confirm that employees are at the correct location when they log attendance, reducing the chances of attendance manipulation.

3. Mobile Accessibility: Expanding the system's accessibility to mobile devices could enhance its usability, allowing employees to track their attendance and submit leave requests on the go. Mobile accessibility would provide greater flexibility for remote employees or those working in the field, ensuring they can use the system regardless of their location.

4. Integration with Payroll Systems: For greater efficiency, integrating the attendance and leave management system with the organization's payroll system would automate the process of calculating pay based on attendance and leave data. This would reduce administrative time and errors related to payroll processing.

5. Feedback and Continuous Improvement: Regularly collecting user feedback and analyzing system usage patterns can provide valuable insights into areas that need improvement. This iterative approach ensures that the system evolves with the changing needs of the organization and its employees. The feedback loop should involve both administrative staff and end-users to ensure that all perspectives are considered in future system upgrades.

APPENDIX A

User login form

The **User Login Form** is a critical component of any system that manages user authentication and access. It acts as the entry point for users, such as administrators or voters, to access the system securely. Upon successful authentication, the login form seamlessly directs the user to their respective interface, without requiring explicit role selection.

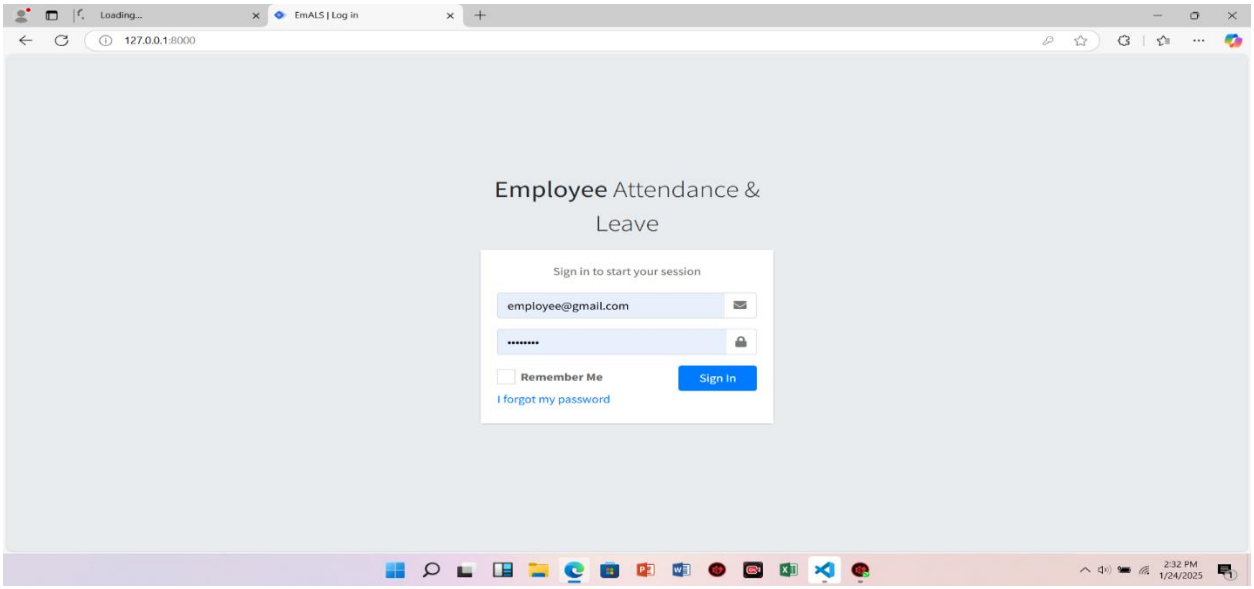


Figure 12: User login page

```
<div class="card">
    <div class="card-body login-card-body">
        <p class="login-box-msg">Sign in to start your session</p>
        {% if messages %}
        <div class="col-12">
            {% for message in messages %}
            {% if message.tags == 'error' %}
            <div class="alert alert-danger text-center ">
                {{ message }}
            </div>
            {% endif %}
            {% endfor %}
        </div>
        {% endif %}
        <form action="doLogin/" method="post">
            {% csrf_token %}
            <div class="input-group mb-3">
                <input required type="email" name='email' class="form-control" placeholder="Email">
                <div class="input-group-append">
                    <div class="input-group-text">
                        <span class="fas fa-envelope"></span>
                    </div>
                </div>
            </div>
            <div class="input-group mb-3">
                <input required type="password" name='password' class="form-control" placeholder="Password">
                <div class="input-group-append">
                    <div class="input-group-text">
                        <span class="fas fa-lock"></span>
                    </div>
                </div>
            </div>
```

APPENDIX B

Admin dashboard

The **Admin Dashboard** serves as the central hub for managing and monitoring employee attendance and leave processes. It provides administrators with a user-friendly interface to oversee operations, generate insights, and ensure policy compliance. This dashboard empowers administrators to maintain control, optimize processes, and ensure smooth HR operations.

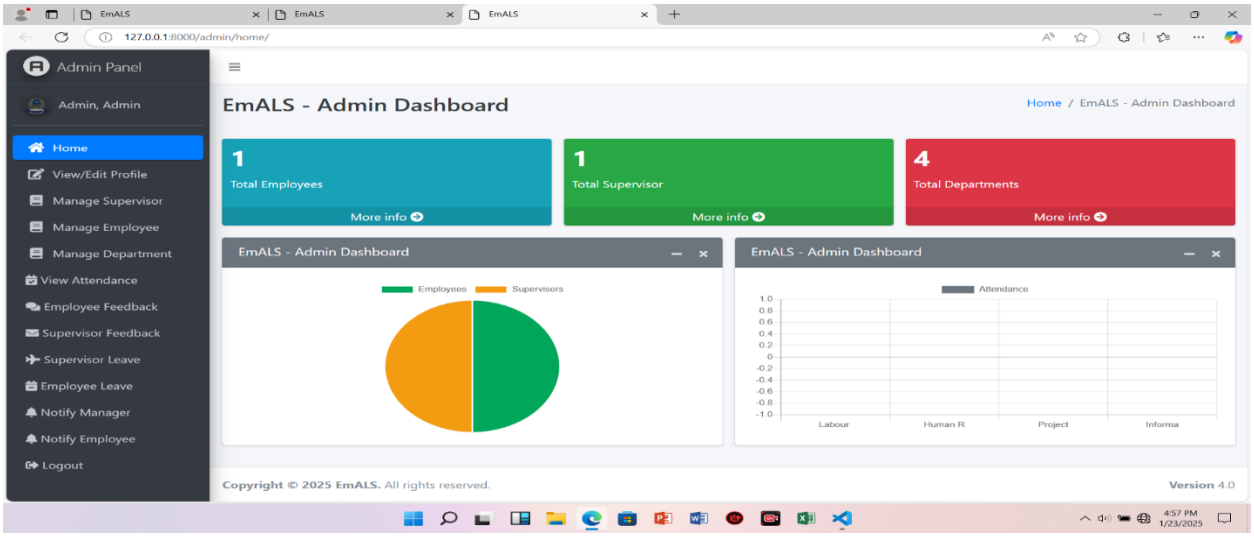


Figure 13: Showing admin dashboard

```
<!-- Small boxes (Stat box) -->
<div class="row">
    <div class="col-lg-4 col-6">
        <!-- small box -->
        <div class="small-box bg-info">
            <div class="inner">
                <h3>{{total_employees}}</h3>

                <p>Total Employees</p>
            </div>
            <div class="icon">
                <i class="ion ion-bag"></i>
            </div>
            <a href="{% url 'manage_employee' %}" class="small-box-footer">More info <i class="fas fa-arrow-circle-right"></i></a>

        </div>
    </div>
    <!-- ./col -->
    <div class="col-lg-4 col-8">
        <!-- small box -->
        <div class="small-box bg-success">
            <div class="inner">
                <h3>{{total_manager}}</h3>

                <p>Total Supervisor</p>
            </div>
            <div class="icon">
                <i class="ion ion-stats-bars"></i>
            </div>
            <a href="{% url 'manage_manager' %}" class="small-box-footer">More info <i class="fas fa-arrow-circle-right"></i></a>
        </div>
    </div>
    <!-- ./col -->
    {% comment %} <div class="col-lg-3 col-6">
        <!-- small box -->
        <div class="small-box bg-warning">
            <div class="inner">
                <h3>{{total_division}}</h3>
```

APPENDIX C

Manage employee

Managing employees effectively involves using automated systems to track working hours, punctuality, and absenteeism while streamlining leave applications and approvals. These systems promote transparency, and support employee satisfaction by adhering to clear policies for leave accrual and scheduling.

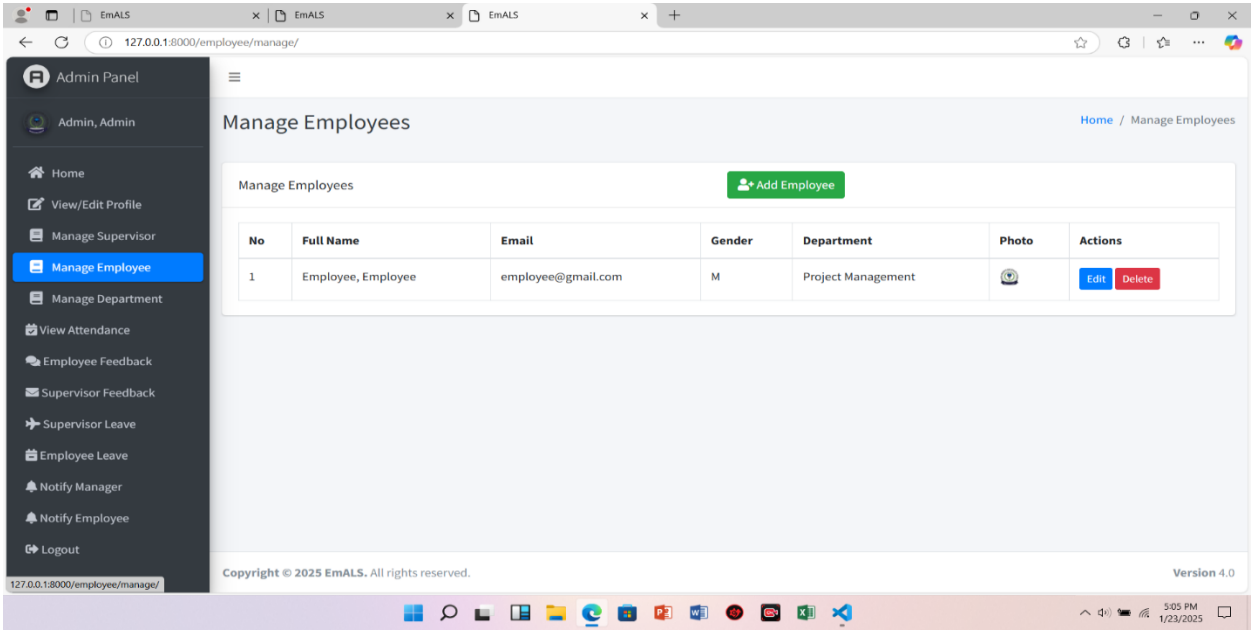


Figure 14: Showing admin's manage employee

```
<div class="card-body">
    <table id="example2" class="table table-bordered table-hover">
        <thead>
            <tr>
                <th>No</th>
                <th>Full Name</th>
                <th>Email</th>
                <th>Gender</th>
                <th>Department</th>
                <th>Photo</th>
                <th>Actions</th>
            </tr>
        </thead>
        <tbody>
            {% for employee in employees %}
            <tr>
                <td>{{ forloop.counter }}</td>
                <td>{{employee.last_name}}, {{employee.first_name}}</td>
                <td>{{employee.email}}</td>
                <td>{{employee.gender}}</td>
                <td>{{employee.employee.department.name}}</td>
                <td>
                    {% if employee.profile_pic == "" %}
                    No Image
                    {% else %}
                    <img class="img img-fluid mb-2" height="25" width="25"
                        src="{{employee.profile_pic}}" alt="">
```

APPENDIX D

Manage leave

Managing employee leave and attendance involves creating a well-defined leave policy, tracking attendance accurately, and maintaining clear communication with employees. The foundation of effective leave management is a comprehensive leave policy that outlines the types of leave available, eligibility criteria, and the procedure for requesting leave. This policy should be communicated to all employees to ensure they understand their entitlements and responsibilities.

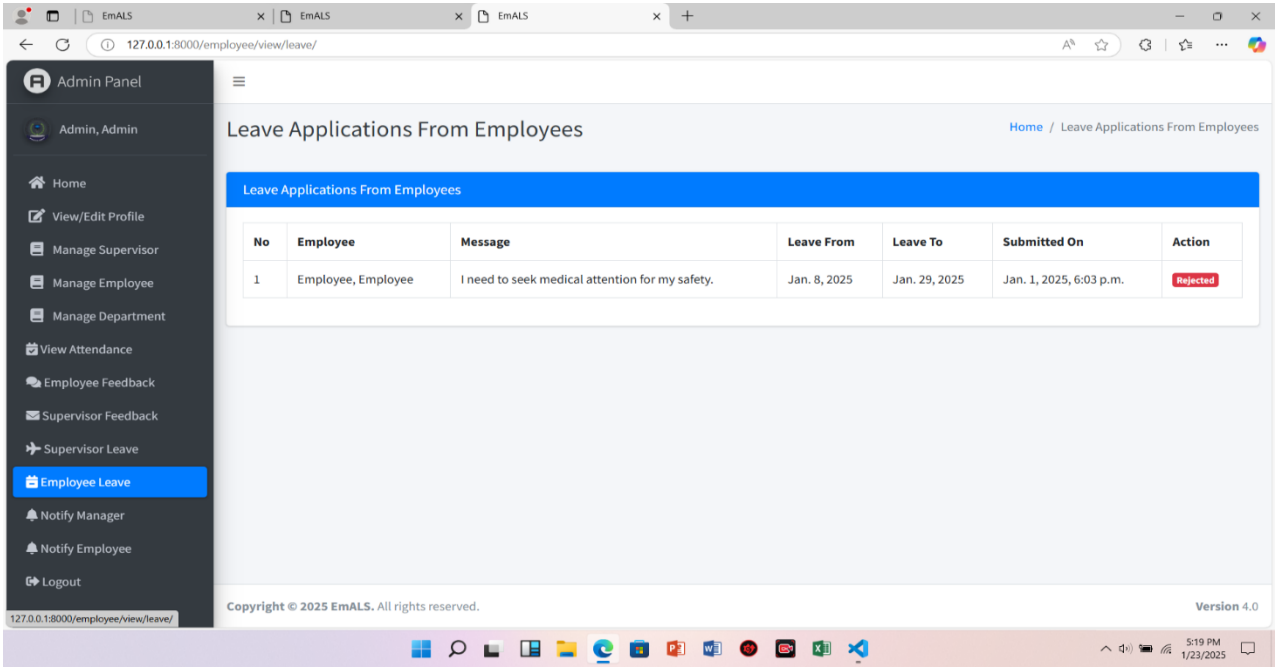


Figure 15: Showing leave applications from employee

```
<div class="card card-primary">
    <div class="card-header">
        <h3 class="card-title">{{page_title}}</h3>
    </div>

    <div class="table card-body">
        <table class="table table-bordered">
            <tr>
                <th>No</th>
                <th>Employee</th>
                <th>Message</th>
                <th>Leave From</th>
                <th>Leave To</th>
                <th>Submitted On</th>
                <th>Action</th>

            </tr>
            {% for leave in  allLeave %}
              <tr>
                  <td>{{forloop.counter}}</td>
                  <td>{{leave.employee}}</td>
                  <td>{{leave.message}}</td>
                  <td>{{leave.start_date}}</td>
                  <td>{{leave.end_date}}</td>
                  <td>{{leave.created_at}}</td>
```

APPENDIX E

Manage attendance

Managing attendance is a vital component of employee attendance and leave management systems, ensuring that employee work hours, punctuality, and productivity are accurately recorded and monitored. These systems integrate seamlessly with leave management, automatically updating attendance records when leave is approved to maintain consistency in payroll and work-hour calculations.

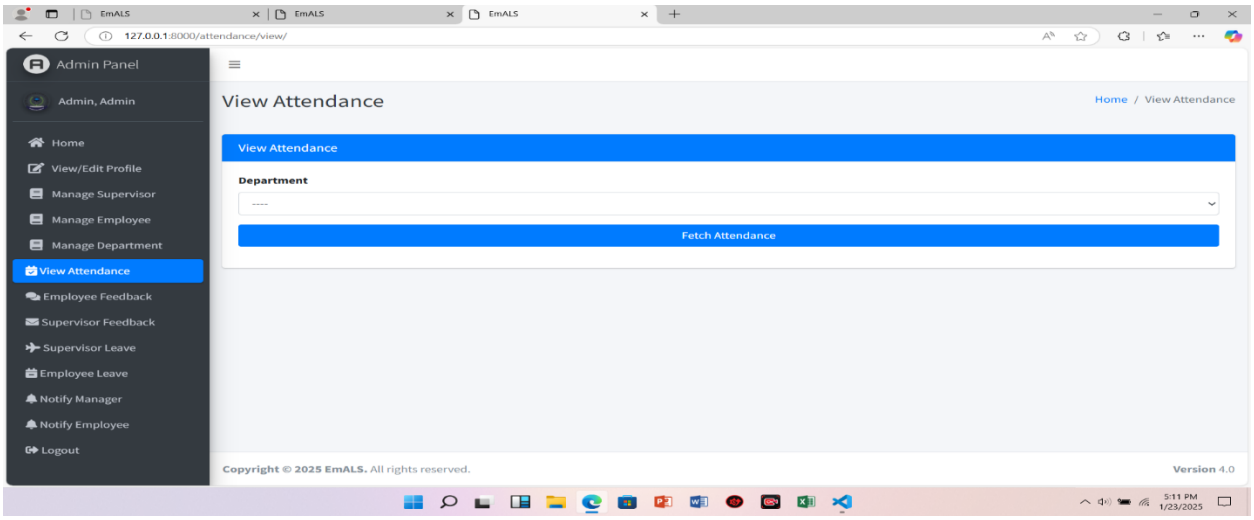


Figure 16: Showing admin's view attendance

```
<div class="card card-primary">
    <div class="card-header">
        <h3 class="card-title">{{page_title}}</h3>
    </div>
    <!-- /.card-header -->
    <!-- form start -->
    <div class="card-body">



        <div class="form-group">
            <label>Select Department</label>
            <select  id="department" class="form-control">
                <option value="">----</option>
                {% for department in departments  %}
                <option value="{{department.id}}">{{department.name}} </option>
                {% endfor %}
            </select>
        </div>
        <div class="row">
            <div class="col-lg-6">
                <div class="form-group">
                    <label>Start Date</label>
                    <input type="date" class="form-control" placeholder="Start Date" name="start_date" required id="start_date">
                </div>
            </div>
            <div class="col-lg-6">
                <div class="form-group">
                    <label>End Date</label>
                    <input type="date" class="form-control" placeholder="End Date" name="end_date"  id="end_date">
                </div>
            </div>
            <button type="button" id="fetch_attendance" class="btn btn-primary btn-block">Fetch
                Attendance Data</button>
</div>
```

APPENDIX F

Supervisor dashboard

The **Supervisor Dashboard** serves as a platform where supervisors manage and monitor their activities as well as employee attendance and leave processes. It provides supervisors with a user-friendly interface to oversee operations, generate insights, and ensure policy compliance. This dashboard empowers administrators to maintain control, optimize processes, and ensure smooth HR operations.

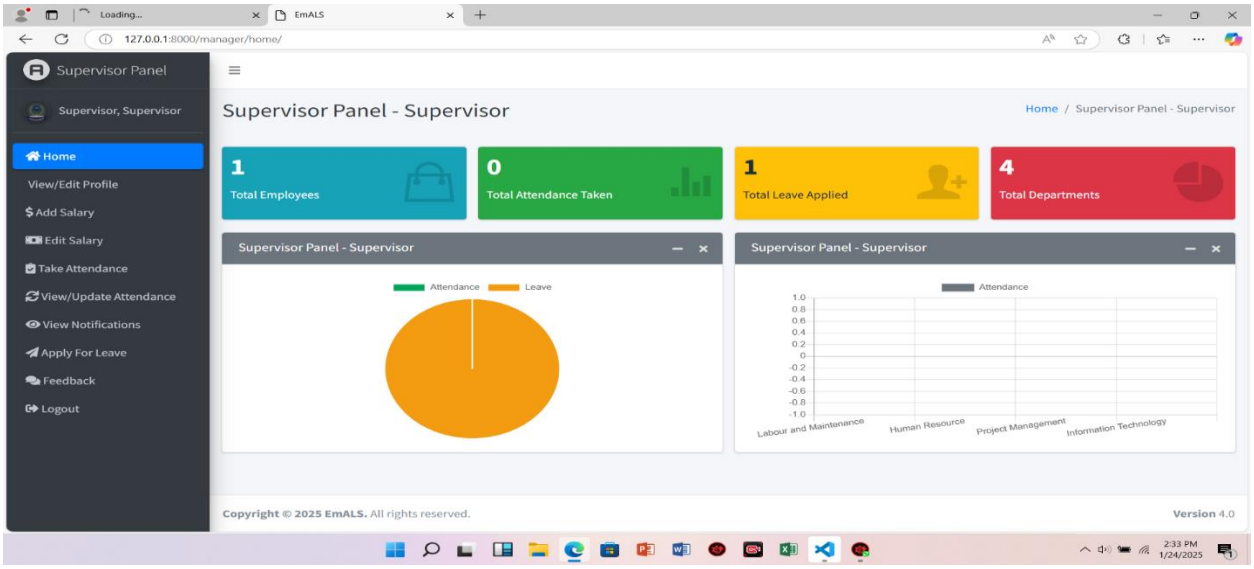


Figure 17: Showing supervisors' dashboard

```
<!-- Small boxes (Stat box) -->
<div class="row">
    <div class="col-lg-3 col-6">
        <!-- small box -->
        <div class="small-box bg-info">
            <div class="inner">
                <h3>{{total_employees}}</h3>

                <p>Total Employees</p>
            </div>
            <div class="icon">
                <i class="ion ion-bag"></i>
            </div>

        </div>
    </div>
    <!-- ./col -->
    <div class="col-lg-3 col-6">
        <!-- small box -->
        <div class="small-box bg-success">
            <div class="inner">
                <h3>{{total_attendance}}</h3>

                <p>Total Attendance Taken</p>
            </div>
            <div class="icon">
                <i class="ion ion-stats-bars"></i>
            </div>

        </div>
    </div>
    <!-- ./col -->
```

APPENDIX G

Employee dashboard

The **employee dashboard** serves as a part of the system where employees manage and monitor their activities as well as their attendance and leave progresses. It provides administrators with a user-friendly interface to oversee operations, generate insights, and ensure policy compliance. This dashboard empowers administrators to maintain control, optimize processes, and ensure smooth HR operations.

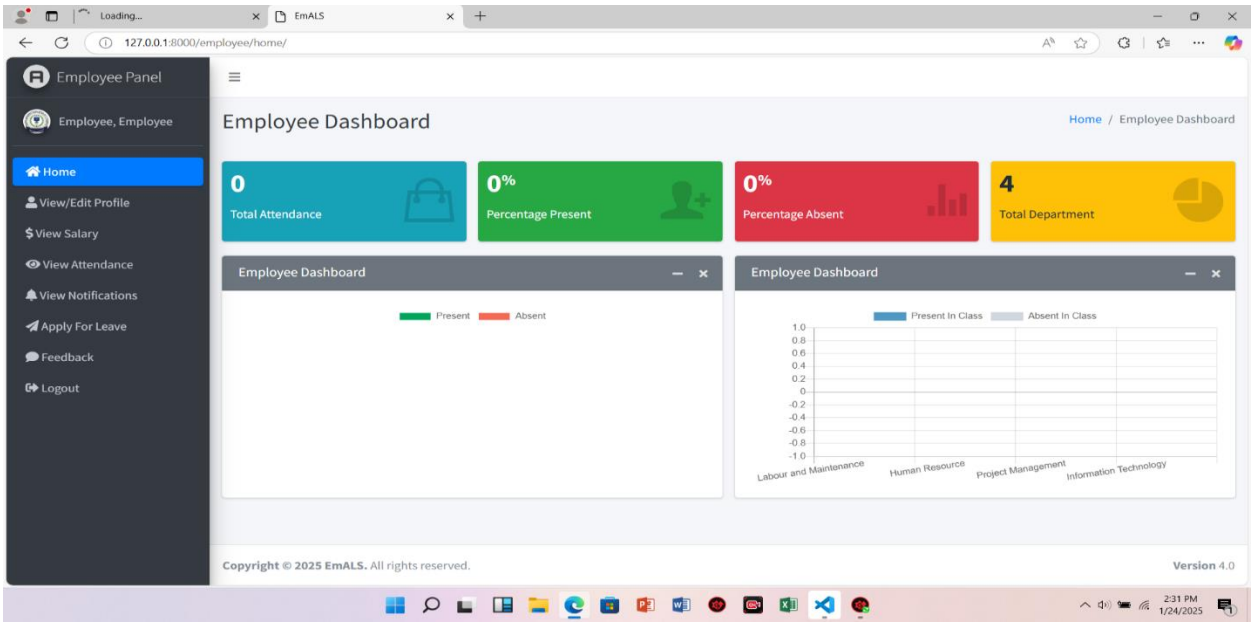


Figure 18: Showing employee dashboard

```
<div class="row">
    <div class="col-lg-3 col-6">
        <!-- small box -->
        <div class="small-box bg-info">
            <div class="inner">
                <h3>{{total_attendance}}</h3>

                <p>Total Attendance</p>
            </div>
            <div class="icon">
                <i class="ion ion-bag"></i>
            </div>
            {# <a href="#" class="small-box-footer">More info <i class="fas fa-arrow-circle-right"></i></a> #}
        </div>
    </div>
    <!-- ./col -->
    <div class="col-lg-3 col-6">
        <!-- small box -->
        <div class="small-box bg-success">
            <div class="inner">
                <h3>{{ percent_present }}<sup style="font-size: 20px">%</sup></h3>

                <p>Percentage Present</p>
            </div>
            <div class="icon">
                <i class="ion ion-person-add"></i>
            </div>
            {# <a href="#" class="small-box-footer">More info <i class="fas fa-arrow-circle-right"></i></a> #}
        </div>
    </div>
    <!-- ./col -->
```

REFERENCES

Ahmed, J., & Joseph, T. (2019). Challenges in adopting digital attendance systems in small businesses. *International Journal of Business Technology*.

Dasgupta, S. (2021). The role of cloud computing in modern HR solutions. *Journal of Enterprise Computing.*

Haque, R. (2021). Overcoming resistance to technology adoption in HR processes. *Human Resource Development Quarterly.*

Hassan, M. (2021). Challenges in manual attendance tracking: A case study. *Journal of Workplace Studies.*

Khan, A., & Thompson, G. (2023). Enhancing employee data security in HR systems. *Cybersecurity and Data Privacy Journal*.

Kumar, R., Sharma, P., & Bansal, A. (2022). A comprehensive review of attendance management systems. *Journal of Information Systems*.

Owolabi, D., Eze, M., & Bello, K. (2020). The inefficiencies of traditional HR systems. *Journal of African Business.* .

Sharma, T., Kumar, S., & Singh, P. (2022). *Digital transformation in attendance tracking: A systematic review.* Digital HR Management Quarterly.

Singh, A., & Gupta, R. (2021). HR process integration: Challenges and solutions. *International Journal of Organizational Technology.* .

Singh, A., Patel, R., & Roy, S. (2021). Advancements in HR technology: Attendance and leave management systems. *Journal of Business and Technology, 34(3)*, 45-60. Retrieved from https://www.researchgate.net/profile/Md-Ahmed-141/publication/354683848_Smart_Attendance_and_Leave_Management_System_Using_Fingerprint_Recognition_for_Students_and_Employees_in_Academic_Institute/links/61463855a3df59440b97e253/

Tan, L., & Low, C. (2021). Adoption of biometric technologies in HR systems. *Journal of Modern Technology.* .