

WEB-BASED INTELLIGENT HUMAN RESROUCE MANAGEMENT SYSTEM

A Capstone Project Proposal

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Chapter 1

PROBLEM AND ITS BACKGROUND

Educational institutions have a myriad of stakeholders that need to operate smoothly to keep the institutes running and the employees engaged. Human Resource Management (HRM) is one of these operational units that proves essential in maintaining employee retention, collective agreement compliance, payroll processing, and workability.

As colleges and universities expand their recruitment of full-timers, part-timers, job-embedded faculty, and instructional designers and staff—those who work in non-teaching job functions—HR becomes increasingly complex. A few of these measures include recruitment, tracking attendance, managing leaves and preparing payroll. Although the digital transformation, which has impacted a number of HR procedures throughout organizations, is not all in one state of digitization at least in its migration from paper to practice.

HR Processes in Private Higher Education Sector that Can Be Digitized Although electronic attendance logs and employee records can be ensured, in most fields, the screening of applicants, discovering distortion, validating leave etc., seems manual. By relying on manual verification processes this leads to an increased administrative burden, extended validation cycle time, and diminished real-time visibility into the workforce.

Colegio de San Gabriel Archangel (CDSGA) employs over 300 people, which includes about 50 full-time professors, 150 part-time teachers, and around 50 non-teaching staff. The Office of the Vice President for Academic Affairs (VPAA) has

people who check if teachers are present, while finance staff members handle payroll. Reconciling attendance takes around three (3) days and an additional three (3) days to prepare payroll, as salaries are paid on the 3rd and 18th of every month.

This gives rise to a highly centralized control architecture that does not scale up and is limited in its use of automated decision-support systems. To the current system, the current system points almost to a record-keeping tool rather than a structured decision-support platform. As the number of employees and complexity of operations grow, it becomes less feasible to conduct manual reviews, increasing the risk of errors and slowing decision-making.

Decision Support Systems (DSS), rule-based analytical models, and Human Resource Analytics are new techniques that challenge the facade of computational Decision is the best decision, emphasizing how formal computational tools significantly contribute to objective, clear, and faster decisions for managers. Rule-based systems are extremely useful in environments where the rules are clear and you can consistently check thresholds.

In this study, we propose the design, development, and evaluation of a Web-Based Intelligent Human Resource Management System (HRMS) that incorporates:

- Scoring systems that favor some applicants more
- Finding strange patterns in attendance
- Leave validation logic.
- Dashboards for HR analytics

The solution retains structured decision-support logic within a web-based, integrated framework that streamlines core HR functions while being mindful of institutional standards and data privacy.

Objectives of the Study

General Objective

To design, create and evaluate a Web-Based Intelligent Human Resource Management System for higher education institutions.

Specific Objectives

1. To design the system architecture and database structure of the proposed HRMS.
2. To create a web-based prototype integrating recruitment, attendance, leave, and analytics modules.
3. To implement a weighted scoring model for applicant shortlisting.
4. To implement a rule-based attendance anomaly detection model.
5. To implement automated leave validation logic based on institutional policy.
6. To deploy the system in a shared hosting environment.
7. To evaluate the system using ISO/IEC 25010 software quality characteristics.
8. To assess system usability using the System Usability Scale (SUS).

Scope and Limitations

Scope

This study covers the design, development, and evaluation of a Web-Based Intelligent Human Resource Management System focusing on core HR functions in a higher education institution. The system includes:

- Applicant management and weighted shortlisting
- Attendance recording and anomaly detection
- Leave management and validation
- HR analytics dashboard
- Role-based access control

The system was implemented based on shared hosting and accessed through web browsers.

HR personnel, selected employees and IT experts (applications developers) were the main evaluators of the system with respect to ISO/IEC 25010 and SUS instruments.

Limitations

The study is conducted within a single institutional setting with approximately 40–60 evaluation respondents. The system does not include full payroll automation nor integration with biometric hardware devices. Intelligence mechanisms are implemented using rule-based logic rather than machine learning algorithms. Additionally, the 45-day development period does not allow long-term stress testing under high concurrency conditions.

The concepting of intelligent HRMS needs to navigate within disciplinary frameworks, together with the technical implementation. An important part of reviewing previous works allows learning from methodological strategies, evaluation criteria, and technical constraints concerning the introduced system. The study thus lays a foundation for the detailed theoretical and empirical underpinnings that are translated into system architecture, computational logic and assessment framework through this review.

This is why Chapter 2 conducts a literature review, to justify the design choices and clarify the research gap that this project is addressing.

CHAPTER 2

Review of Related Literature and Studies

Related Literature and Studies

When designing a Web-Based Intelligent Human Resource Management System (HRMS), it is essential to ground the system in established theoretical frameworks and empirical research. This chapter reviews literature on HRIS, Decision Support Systems (DSS), rule-based computational models, HR analytics, data privacy, and software quality evaluation frameworks. A systematic review of the relevant literature offers theoretical grounding and practical aspects associated with designed requirements, implementation experiences, and assessment frameworks of institutional HR systems. This chapter (1) articulates existing technological patterns, scientific techniques used to study these patterns in past studies, and research gaps—through critical synthesis of prior studies—that underpin the conceptual and structural architecture of the proposed system.

HRIS in Higher Education Institutions

Human Resource Information Systems (HRIS) have progressed from simple digital record lodgers to holistic platforms that assist with workforce management, payroll coordination, and performance tracking. HRIS implementations benefit administrative efficiency, data consolidation and reporting accuracy in higher education organizations. And foreign studies show that the practice is increasing in adoption among academic institutions for two main reasons: the decentralization of departmental structures and growing faculty populations.

While HRIS adoption adds to operational efficiency, most implementations are automation-based. Systems mainly deal with attendance logging, payroll data processing and retaining employee records. More sophisticated decision-support tools — anomaly detection, applicant-ranking by weight, integrated analytics dashboards — are rarely built.

Similar benefits are shown by Philippine-based HRIS studies resulting in improvements in administrative processing and the reduction of errors. However, local implementations often are focused more around digitization of manual workflows than embedding structured computational intelligence into the system architecture.

Synthesis:

As technology-oriented systems often pursue automation, the literature indicates there is a technological maturity gap between automation-focused and intelligence-enabled HR systems, particularly within higher education in the Philippines.

Decision Support Systems & Rule-Based Models in HR

Decision Support Systems (DSS) are systems that add structured computational logic to data for the purpose of aiding managerial decision-making. In human resource (HR) situations, DSS frameworks are routinely employed for screening candidates, performance assessment and labor force planning. Weighted scoring mechanisms are used in many multi-criteria decision-making environments to add objectivity and transparency to candidate evaluation.

This is where rule-based systems shine, offering the transparency of predetermined thresholds and policy-driven validation rules. Unlike machine learning models, rule-based approaches are interpretable and transparent, which is essential in institutional HR governance.

Nevertheless, previous studies tend to study recruitment scoring systems or attendance monitoring systems or HR analytics in isolation rather than interlinking these modules into a streamlined HR lifecycle system.

Synthesis:

DSS and rule-based studies already show the validity of computational support to HR decisions but they also show fragmentation in terms of implementation. But, so far there is limited evidence of integrated, lifecycle-based intelligent HRMS model in higher education institution.

Systems for Anomaly Detection and Monitoring Attendance

Attendance systems during data as old as October 2023 only act as logging tools for time-in and time-out of an employee. Recent studies emphasize the role of anomaly detection mechanisms in flags based on abnormal attendance behaviors with regards to productivity or payroll calculation.

Threshold-based models of classification are especially appropriate in accordance with clearly defined attendance policies often encountered at institutions. Such models provide the classification of the risk level, depending on predefined rules such as count days late entries or consecutive absence dates.

Although attendance monitoring systems have already been available, existing structured risk-scoring frameworks embedded in institutional HR systems remain limited, especially in the Philippine academic context.

Synthesis:

Though attendance logging systems are already commonplace, formalized anomaly detection and risk classification mechanisms at the HR end in higher education environments are still nascent.

HR Analytics and Workforce Intelligence

The data collected by HR analytics is used to drive Directions in a dashboard, analyse trends, and report systematically. HMR international studies relate HR analytics adoption to better managerial decision-making, productivity gains and transparency in workforce governance.

But most institutional HR systems are prescriptive, not predictive. Analytics modules generally aggregate and report data but don't contain formal computational interpretation such as risk scores or classification.

Synthesis:

While HR analytics has been recognised as a strategic tool for generations and many data-driven decision-making paradigms have emerged, it is still under-exploited by UN organizations in the context of rule-based decision-support mechanisms embedded into one single institutionalized HRMS.

Data Privacy and Security in HR Information Systems

HR processes sensitive personal, financial and employment data as part of the HR

System, thus privacy and security are two must have requirements for any system. We are obliged to implement appropriate technical and organizational measures for personal information in compliance to the 2012 Philippine Data Privacy Act of 2012 and related National Privacy Commission (NPC) guidelines.

Consideration: Data breaches may be prevented by having proper security mechanisms in place, including role-based access control and authentication protocols as well as encrypted communication channels and restricted database access. Compliance with privacy regulations must be baked into the system design as an integral feature in institutional HR environments, not penalized after the fact.

Synthesis:

HRMS architecture must operationalize principles of data privacy and security to ensure regulatory compliance and fidelity in organizations.

System Evaluation in the lights of ISO/IEC 25010 & System Usability Scale

ISO/IEC 25010 is a standard for software quality that identifies several characteristics by which any software can be evaluated, including functional suitability, usability, performance efficiency, security and reliability. The model facilitates structured assessment of system effectiveness and technical performance.

The System Usability Scale (SUS) is an established measurement tool for perceived usability with a ten-item standardized survey instrument. The combination of ISO/IEC 25010 system-level quality and SUS usability provides a more holistic evaluation covering technical quality as well as user experience.

Synthesis:

By integrating ISO/IEC 25010 and SUS, methodological rigor is enhanced as this process ensures that the developed HRMS is assessed not only in technical quality but also for its acceptability by end-users.

Conceptual Model of the Study

Figure 1: Conceptual Framework

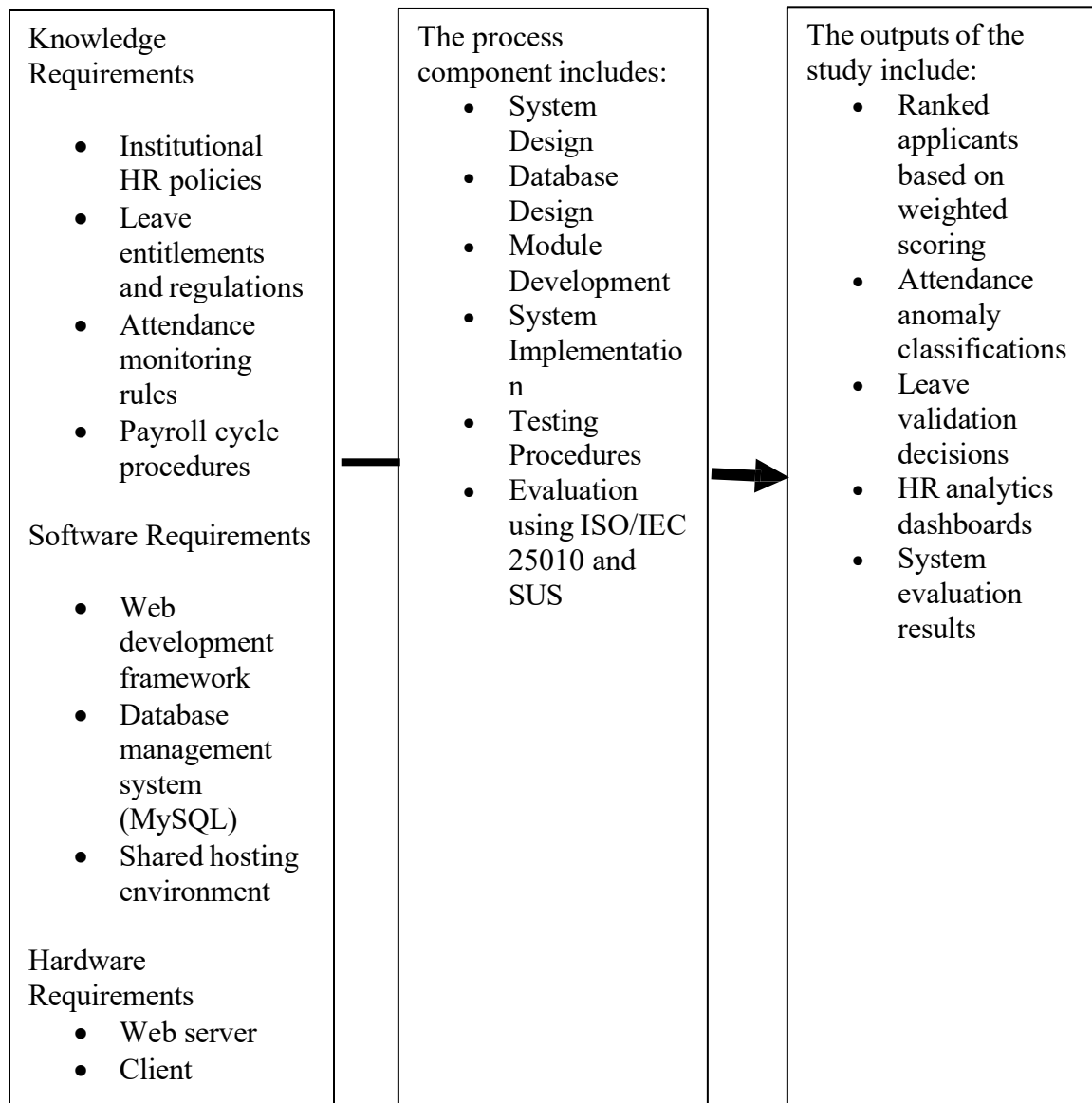


Figure 1
Conceptual Framework

Research Gap and Positioning of the Study

Research Gap

Our critical synthesis of extant literature indicates that whilst HRIS implementations have enabled significant administrative efficiencies and enhanced data management in educational institutions, they tend to be largely automation-based, rather than intelligence-based.

To begin with, most institutional HR systems are focused on automating manual workflows like attendance logging, payroll consolidation or record storage. While these systems alleviate clerical burden, they seldom incorporate structured computational decision-support mechanisms such as weighted applicant-ranking or rule-based anomaly detection or risk-based classification models. So, automation is delivered but decision intelligence has not matured.

A second caveat is that recruitment screening, attendance monitoring, leave management and HR analytics are often handled in separate modules or as isolated systems by previous studies. No record exists of an integrated institutional HRMS in the context of the Philippine higher education which captures these core life cycle functions on a rule-based intelligent architecture.

Third, attendance systems in the anomaly detection research environment are limited to biometric validation or logging accuracy rather than structured risk-scoring frameworks that conform with institutional HR governance. The operational classification processes for attendance deviation into managerial risk mechanisms still constitute an underexplored dimension of local academia.

Fourth, while the ISO/IEC 25010 framework is commonly utilized for estimating software quality and SUS is internationally accepted to assess usability, there are limited studies in Philippine-based institutional HR systems comprehensively evaluating both frameworks at once. This highlights a methodological gap in the overall assessment of artefacts specific to the local context.

These gaps collectively suggest that existing HRIS implementations in higher educational institutions focus primarily on operational digitization while neglecting to fully integrate decision-support intelligence, lifecycle integration, and rigorous dual-framework evaluation.

Positioning of the Present Study

This study addresses the identified gaps directly by designing and evaluating a Web-Based Intelligent Human Resource Management System (HRMS) that:

1. Utilizes weighted applicant scoring to standardize short-listing recruitment decisions.
2. Employing rule-based mechanism for attendance anomalies identification with schema risk classification.
3. Automates leave validation per institutional policy thresholds.
4. It brings together recruitment, monitoring and analytics in a single HR lifecycle architecture.

5. Integrates privacy-by-design mechanisms, in line with Philippine data protection requirements.
6. Using the ISO/IEC 25010 and the System Usability Scale (SUS) to assess the developed artifact.
7. Development of a grounds system in accordance with Design Science Research (DSR) guidelines.

By establishing structured computational intelligence, lifecycle integration and standardised evaluation in a Philippine higher education setting, this paper contributes to institutional HRMS research advancing from automation-integrated departmental operation into intelligence-enabled governance.

Operational Definition of Terms

For clarity of purpose, the following terms are operationally defined by their use in this study:

Anomaly Detection – The process of rule base classification of attendance anomalies through predefined threshold in the developed HRMS.

Applicant Shortlisting refers to the weighted scoring process application used for ranking job applicants based on specific evaluation criteria.

Attendance Reconciliation – This process defines the verification and integration of employees attendance records before processes payroll.

Decision Support System (DSS) – is a system providing managerial decision-making support with structured and programmed logic of calculations implemented in the developed HRMS.

Human Resource Analytics – analysis and visualization of HR data, which helps in managing the workforce and improving managerial decisions.

Human Resource Management System (HRMS) – this refers to the developed WebBased Intelligent HRMS prototype in this study.

ISO/IEC 25010 – international software quality model, resulting system reference.

Leave Validation – an automated process to verify requests for leave against institutional policy compliance.

Rule-Based System – a model, that uses logical rules to process HR data and draws conclusions from it.

Chapter 3

METHODOLOGY

Project Design

This study adopts a system development approach in designing the Web-Based Intelligent Human Resource Management System (HRMS). During the design phase, work was devoted to defining system architecture, database structure, models for intelligent computation and access mechanisms for users.

System Architecture

The architected HRMS was built on a three-layer web-based architecture comprising:

- Presentation Layer – web-based user interface, which can be accessed using standard browsers.
- Application Layer – processing layer on the server side that includes rule-based logic, weighted scoring computation and an anomaly detection algorithm.
- Data Layer – MySQL Relational database for secure storage of user credentials, attendance records, applicants data and leave Transactions.

The access control has been implemented based on the user type (HR personnel, employee, and IT evaluator) through role-based access control (RBAC).

Database Design

We used relational principles to design on the database and normalized it up to Third Normal Form (3NF) for eliminating redundancy and ensuring data integrity.

Core tables included:

- Users
- Employees
- Applicants
- Attendance
- Leave Requests
- Evaluation Records

Referential integrity was maintained through the definition of primary and foreign keys.

Intelligent Model Design

The following computational mechanisms were integrated by the system:

Applicant Weighted Scoring Model

$$\text{Score} = \sum(W_i \times C_i)$$

Where:

- W_i = assigned weight
- C_i = normalized criterion score

Criteria included educational qualification, years of experience, certifications, and interview rating.

Attendance Anomaly Detection Model

$$\text{Risk Score} = (\text{Late} \times 1) + (\text{Absence} \times 2) + (\text{Missing Log} \times 2)$$

Risk levels were classified as:

- 0–2 : Low Risk
- 3–4 : Moderate Risk
- 5 and above : High Risk

System Process Flow

The overall system workflow followed a structured sequential process from user authentication to system output generation.

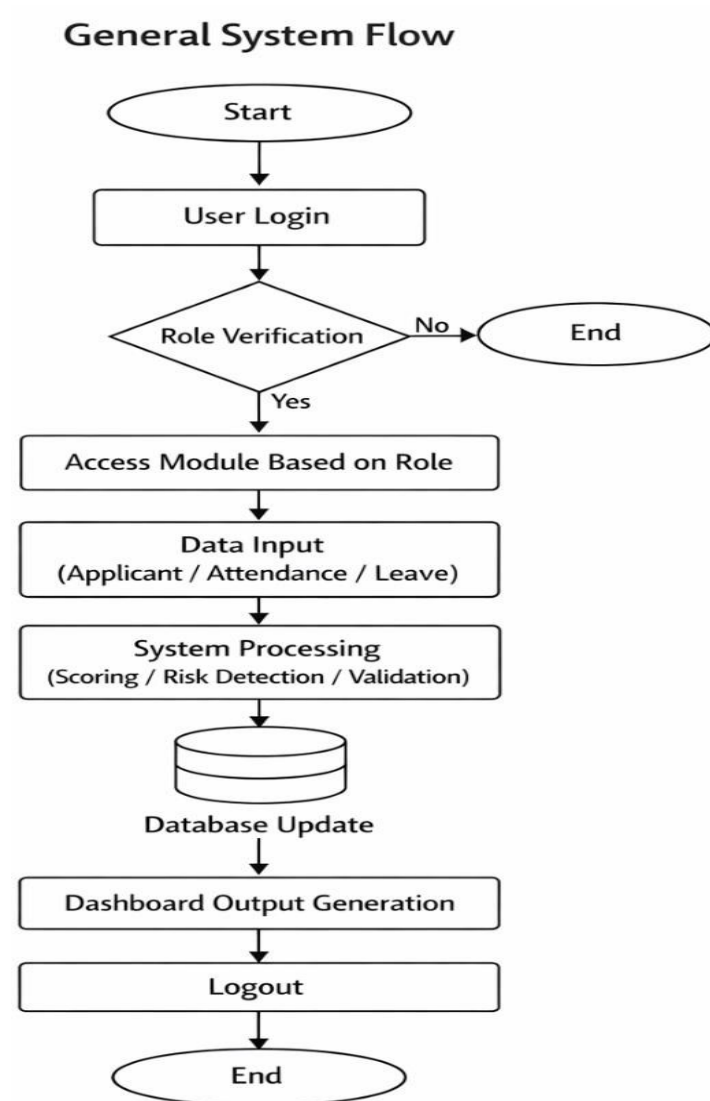


Figure 2
System Process Flow

Applicant Scoring Flowchart Description

HR Applicant Evaluation Flow

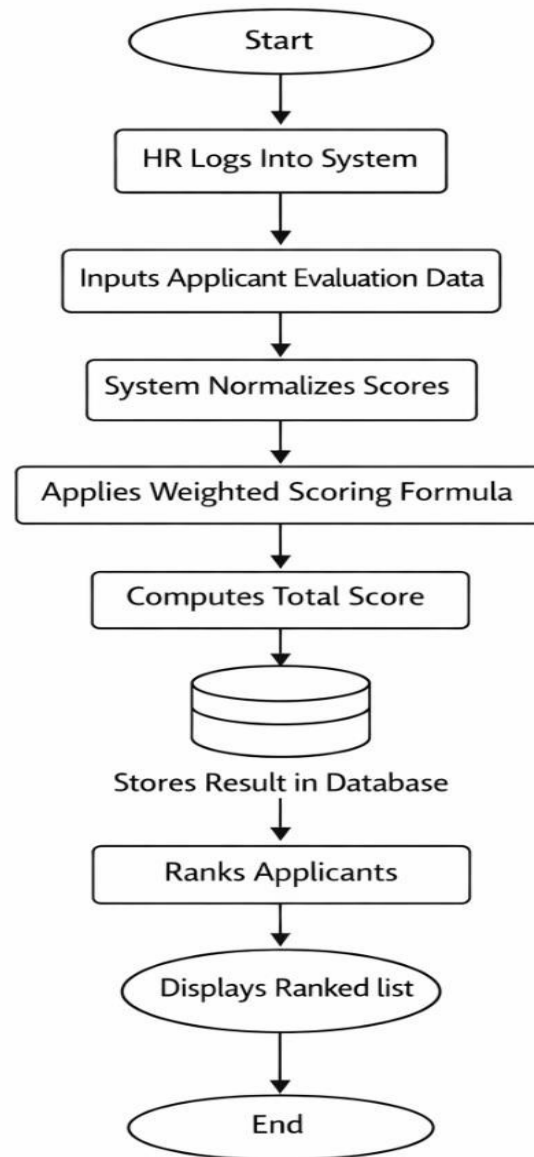


Figure 3
Applicant Scoring Flowchart Description

Attendance Anomaly Detection Flowchart Description

Employee Attendance Monitoring Flow

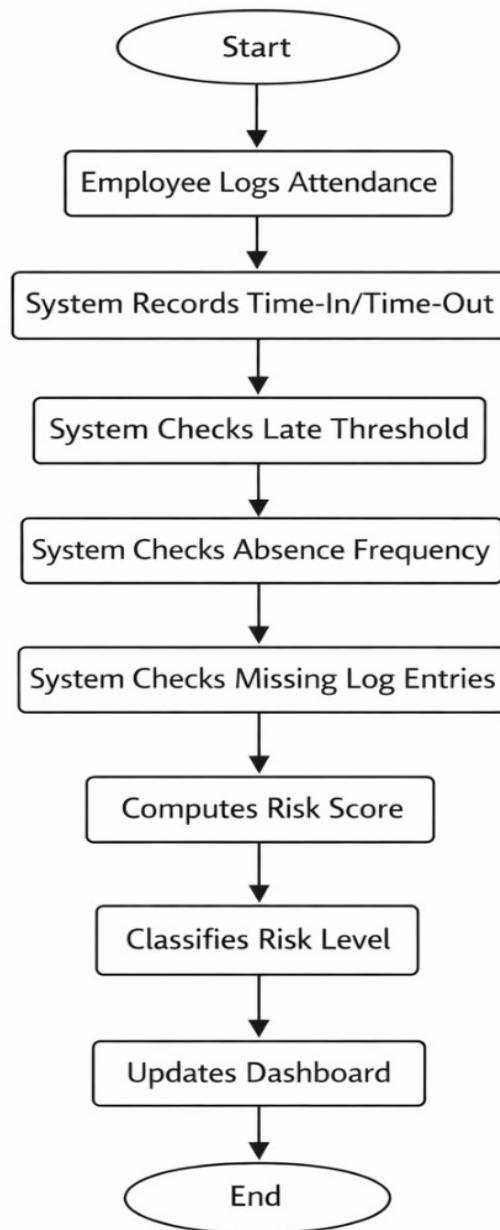


Figure 4
Attendance Anomaly Detection Flowchart
Description

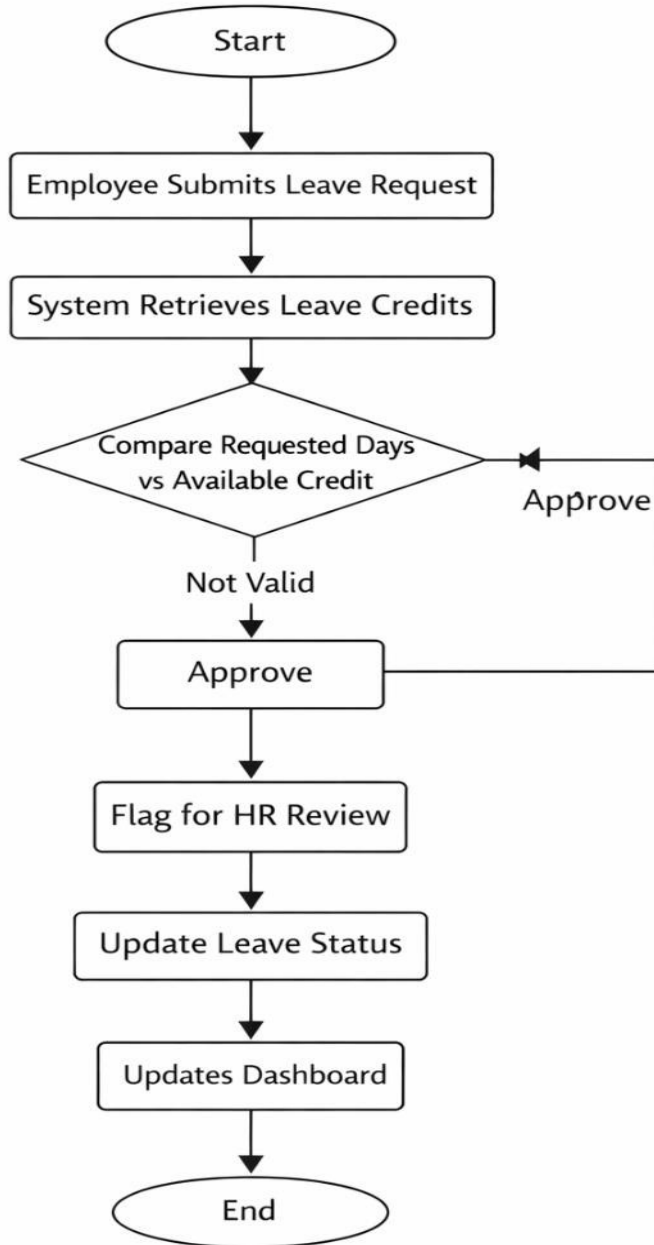
Leave Validation Flowchart Description**Employee Attendance Monitoring Flow**

Figure 5
Leave Validation Flowchart Description

Project Development

The system development was completed in structured phases over a 45-day implementation period.

Development Environment

The system was developed using:

- Web-based development framework (PHP-based environment)
- MySQL database management system
- Shared hosting platform (Hostinger)
- Web browser to test and deploy your template

Module Development

The modules were developed in succession:

1. Authentication and User Management Module
2. Applicant Management and Scoring Module
3. Module for Attendance Monitoring and Anomaly Detection
4. Leave Management Module
5. HR Analytics Dashboard

In this series the the two components were tested individually before assembly.

Security Implementation

Security measures included:

- Password hashing
- Role-based access control
- SSL-enabled hosting

Operation and Testing Procedure

System Operation Procedure

A Data Collection System The system worked in the following steps:

1. User logged in with their assigned credentials.
2. Applicants scoring module was used by HR personnel to key in evaluation data.
3. Weighted scores based on multiple criteria, applicant ranks
4. Employees recorded attendance entries.
5. System calculated a risk score and classified attendance/classroom behavior.
6. Employees submitted leave requests.
7. System validated leave eligibility automatically.
8. Dashboard displayed analytics summaries.

Testing Procedure

Testing was carried out in two parts:

Functional Testing

- Verification of module outputs
- Validation of scoring accuracy
- Confirmation of anomaly classification

System Testing

- End-to-end workflow testing
- Access control testing
- Data consistency verification

Test cases were created to verify system integrity and accuracy.

Testing Procedure (Expanded with Templates)

Test Case ID	Module	Input	Expected Output	Actual Output	Status (Pass/Fail)
TC-01	Login	Valid credentials	Access granted	Access granted	Pass
TC-02	Applicant Scoring	Input criteria values	Ranked score computed	Ranked score computed	Pass
TC-03	Attendance	3 late entries	Moderate Risk	Moderate Risk	Pass
TC-04	Leave Validation	Leave > credit	Flag for review	Flag for review	Pass

Table 1
Functional Testing Results

System Testing Template

Scenario	Description	Result	Remarks
S1	End-to-end recruitment process	Successful	No errors
S2	Attendance-to-dashboard update	Successful	Real-time update
S3	Leave request validation	Successful	Automatic approval

Table 2
System Integration Testing

Evaluation Procedure

Respondents

The system was evaluated by:

- 3 HR personnel
- 30–50 employees
- 3–5 IT experts

Respondents were selected using purposive sampling.

Evaluation Instruments

The system was evaluated using:

1. ISO/IEC 25010 Software Quality Model
 - Functional Suitability
 - Performance Efficiency
 - Usability
 - Security
 - Reliability
2. System Usability Scale (SUS)

Likert Scale

A five-point Likert scale was used:

Scale	Interpretation
5	Strongly Agree
4	Agree
3	Neutral
2	Disagree
1	Strongly Disagree

Table 3
Likert Scale

Statistical Treatment

The following statistical tools were used:

- Mean
- Weighted Mean
- Variance
- Standard Deviation
- Cronbach's Alpha for reliability

SUS scores were computed using the standard formula and interpreted using established usability benchmarks.

ISO/IEC 25010 Evaluation Summary Template

Quality Characteristic	Mean	Standard Deviation	Interpretation
Functional Suitability	—	—	—
Performance Efficiency	—	—	—
Usability	—	—	—
Security	—	—	—
Reliability	—	—	—
Overall Mean	—	—	—

Table 4
ISO/IEC 25010 Evaluation Result

SUS Scoring Template

Respondent	SUS Score
R1	—
R2	—
...	...
Mean SUS Score	—

Table 5
System Usability Scale (SUS) Result

Interpretation Guide:

- 80–100 → Excellent
- 68–79 → Good
- 50–67 → Acceptable
- Below 50 → Poor

Reliability Testing Template (Cronbach's Alpha)

Instrument	Number of Items	Cronbach's Alpha	Interpretation
ISO 25010	—	—	—
SUS	—	—	—

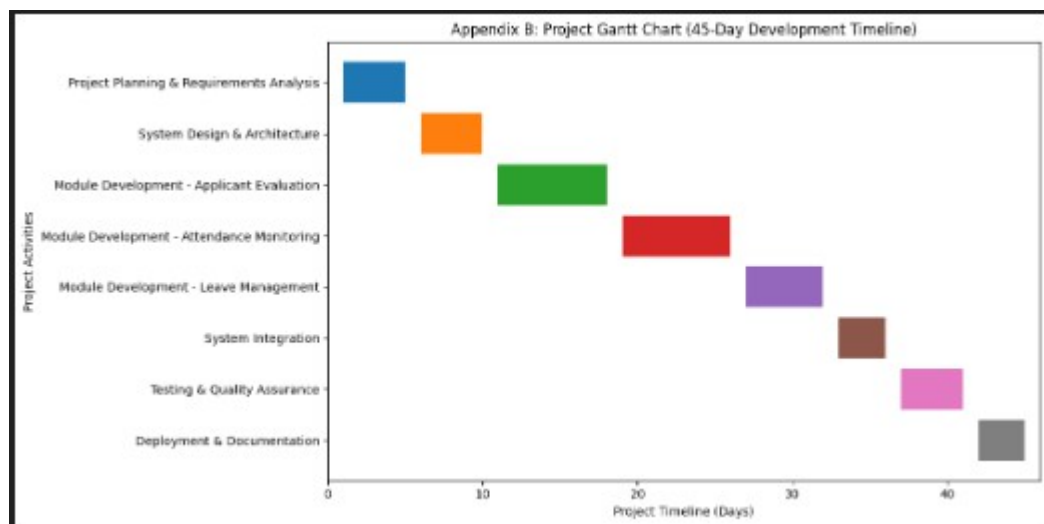
Table 6
Reliability Analysis

Interpretation:

- ≥ 0.90 → Excellent
- ≥ 0.80 → Good
- ≥ 0.70 → Acceptable

Gantt Chart Reference Section

The development timeline was structured over a 45-day period, detailing module implementation, testing, and deployment phases. The Gantt chart is presented in Appendix B.



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