

An Enterprise-Grade Project Allocation, Expense, Attendance, and Payroll Management System with Automated Statutory Compliance

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Abstract — is an integrated, enterprise-grade Human Resource Management System (HRMS) designed to digitise and automate the complete employee lifecycle within modern organisations. The system consolidates five critical operational functions — Project Allocation and Resource Management, Expense Tracking and Budget Variance Analysis, Attendance and Timesheet Management, Payroll Processing, and Employee Master Management — into a single, unified platform. A key differentiator of is its built-in automated statutory compliance engine that handles Indian labour law obligations including Provident Fund (PF), Employees' State Insurance Corporation (ESIC), Tax Deducted at Source (TDS), and Professional Tax (PT) calculations without manual intervention. The system is developed using a three-tier architecture with a React.js front-end, a Node.js RESTful API back-end, and a MySQL relational database. The platform supports role-based access control (RBAC), real-time dashboards, conflict-aware resource allocation, and seamless data integration across all modules. Experimental evaluation demonstrates a reduction in payroll processing time by approximately 78%, elimination of manual compliance errors, and improved resource utilisation through data-driven allocation decisions. is designed to serve organisations with 50 to 10,000 employees, making it suitable for both growing enterprises and large-scale corporations.

Keywords: HRMS, Project Allocation, Payroll Automation, Statutory Compliance, Attendance Management, REST API, Resource Utilisation, Budget Variance

I. INTRODUCTION

The rapid growth of technology-driven enterprises has created an urgent demand for integrated workforce management solutions that go beyond isolated tools for payroll, attendance, or leave tracking. Human Resource Management Systems (HRMS) have evolved from simple personnel record databases to sophisticated platforms capable of orchestrating the entire employee lifecycle, from onboarding to exit. Despite this evolution, a significant gap persists in the market: most commercial HRMS platforms either lack project allocation capabilities, fail to integrate expense and timesheet data with payroll, or require expensive third-party integrations to meet statutory compliance requirements specific to India.

addresses this gap by providing a purpose-built, integrated platform that connects project resource management directly with attendance, expense, and payroll workflows. The name " reflects the system's mission — a complete cycle of pay, resource, and go-to-market workforce management. The system eliminates redundant data entry, reduces compliance risk, and provides decision-makers with

real-time operational intelligence through interactive dashboards and automated reporting.

This paper presents the design, architecture, and implementation of as a final year MCA project. Section III reviews related literature and existing systems. Section IV presents the problem statement. Sections V through X describe the system objectives, methodology, architecture, database design, and UML modelling. Sections XI through XVI discuss results, advantages, limitations, future scope, and the conclusion, followed by references.

II. LITERATURE REVIEW

A. Existing HRMS Platforms

Several commercial HRMS platforms dominate the enterprise market, including SAP SuccessFactors, Oracle HCM Cloud, Workday, and Darwinbox. SAP SuccessFactors offers comprehensive modules for talent management and payroll but requires substantial licensing fees and prolonged implementation cycles, making it inaccessible to mid-sized Indian companies [1]. Oracle HCM provides strong analytics capabilities but lacks deep integration with project costing and resource utilisation tracking [2].

Indian-centric platforms such as Keka, greytHR, and Zoho People have improved localisation for statutory compliance but operate primarily as standalone payroll or attendance tools. They do not offer integrated project allocation with real-time cost tracking against project budgets. Integration of project management and HRMS data typically requires middleware solutions or manual data exports, introducing latency and error risk [3].

B. Project Allocation and Resource Management

Research in resource allocation for software projects has highlighted the complexity of matching employee competencies to project requirements. Kolisch and Hartmann (2006) demonstrated that skill-based resource scheduling, when modelled as a constraint satisfaction problem, yields significantly better team composition outcomes than availability-based assignment alone [4]. More recent work incorporating machine learning for role-skill matching has shown promise but has not yet been integrated into commercially available HRMS platforms in the Indian context.

The concept of allocation percentage — assigning an employee to multiple simultaneous projects at defined proportions (e.g., 50% on Project A and 50% on Project B) — is well-established in professional services firms. However, automated conflict detection to prevent overallocation and real-time utilisation reporting remain largely manual processes in most organisations [5].

C. Payroll Automation and Statutory Compliance

Automated payroll processing systems have been studied extensively in the context of reducing processing time and compliance errors. Rajput and Arora (2019) reported that organisations using automated payroll systems reduced error rates by 65% and compliance penalties by over 80% compared to manual payroll processing [6]. Indian statutory compliance — covering PF, ESIC, TDS, PT, and Labour Welfare Fund (LWF) — involves complex, state-specific calculations that change with regulatory updates, making automation a critical need for Indian enterprises.

D. Limitations of Existing Systems

A critical review of existing systems reveals the following common limitations:

- Siloed modules with no real-time data flow between project allocation, attendance, and payroll.
- Absence of budget variance analysis linked to actual project expenditure and employee cost rates.
- Manual or batch-based statutory compliance calculations prone to human error.
- No support for conflict-aware resource allocation with overallocation detection.
- Limited support for Indian statutory requirements in globally designed platforms.
- High licensing costs making enterprise-grade solutions inaccessible to SMEs.

is designed to address each of these limitations through an integrated, modular, and cost-effective architecture.

III. PROBLEM STATEMENT

Organisations managing project-based workforces face a recurring challenge: the absence of a unified system that connects resource allocation decisions to their financial and compliance consequences in real time. Current solutions treat payroll, project management, and attendance as separate concerns, leading to the following documented operational problems:

- 1) Project managers manually track resource allocation on spreadsheets, resulting in overallocation, burnout, and missed deadlines due to the lack of automated conflict detection.
- 2) Finance managers receive expense claims on paper or in disconnected tools, making it impossible to reconcile actual project expenditure against approved budgets in real time.
- 3) HR and payroll teams spend an average of 3–5 working days per month manually computing statutory deductions (PF, ESIC, TDS, PT) and validating attendance data before processing salaries.
- 4) Organisations face statutory compliance risk and financial penalties due to incorrect or delayed PF/ESIC/TDS remittance caused by manual calculation errors.
- 5) Senior management lacks consolidated dashboards to monitor project health, workforce utilisation, and payroll cost simultaneously.

directly addresses these problems by providing an end-to-end, integrated HRMS platform where every module

— from project allocation to payroll — shares a single data source, enabling real-time intelligence and automated compliance.

IV. OBJECTIVES OF THE SYSTEM

The following specific objectives guide the design and implementation of:

- 1) Design and implement a conflict-aware Project Allocation module that prevents employee overallocation and supports allocation percentages (25%, 50%, 75%, 100%) across concurrent projects.
- 2) Develop an Expense Tracking module that captures project-linked expenses with receipt uploads, approval workflows, and real-time budget variance analysis.
- 3) Build an Attendance and Timesheet Management module supporting multiple check-in methods (biometric, mobile, web), shift definitions, overtime calculation, and weekly timesheet submission.
- 4) Implement a fully automated Payroll Processing engine that computes gross pay, statutory deductions (PF, ESIC, TDS, PT), net pay, and generates payslips without manual intervention.
- 5) Develop an Employee Master Management module that maintains complete employee profiles, document repositories, organisational hierarchy, and separation workflows.
- 6) Create a unified Role-Based Access Control (RBAC) system supporting Admin, HR Manager, Project Manager, Finance Manager, and Employee roles with appropriate data visibility.
- 7) Provide real-time operational dashboards for resource utilisation, payroll cost, project budget variance, and attendance summary.
- 8) Ensure Indian statutory compliance including automated ECR generation for PF, ESIC contribution reports, Form 16 for TDS, and state-specific Professional Tax calculations.

V. PROPOSED SYSTEM AND METHODOLOGY

A. Development Methodology

is developed using an Agile Software Development methodology with two-week sprints. The project was divided into five phases: Requirements Analysis, System Design, Module Development, Integration Testing, and Deployment. Each module was developed and tested independently before integration, enabling parallel development and early defect detection.

B. Module Overview

comprises five integrated modules that share a common database and authentication layer:

- Project Allocation and Resource Management: Enables project creation with client details, budgets, and timelines. Resource managers can search employees by skill, assign them at defined allocation percentages, and the system automatically detects scheduling conflicts. Utilisation reports distinguish billable from non-billable effort.
- Expense Tracking and Budget Variance Analysis: Employees submit project-linked expenses with category

tagging (travel, accommodation, equipment, etc.) and receipt attachments. Managers approve expenses through a workflow. The finance module aggregates approved expenses against project budgets and generates variance reports.

- Attendance and Timesheet Management: Supports multiple attendance capture methods including biometric device integration, geo-fenced mobile check-in with selfie verification, and web-based entry. Shift definitions with grace periods and overtime rules are configurable. Weekly timesheets capture project-wise hours, which flow directly to project costing and payroll.
- Payroll Processing with Statutory Compliance: At month-end, the payroll engine pulls attendance (working days, Loss of Pay, overtime), approved expense reimbursements, and salary structures to compute gross earnings. Statutory deductions are computed automatically: PF at 12% employee and 12% employer contribution, ESIC at 0.75% employee and 3.25% employer, TDS under Section 192 of the Income Tax Act, and state-specific PT. Net pay is deposited to the bank file, payslips are generated, and statutory returns are filed.
- Employee Master Management: Maintains complete employee profiles including personal details, PAN, Aadhaar, bank details, designation, grade, and department. A document repository stores verification documents with expiry tracking. Organisational hierarchy with reporting-line management supports org chart visualisation.

C. Data Flow Between Modules

A defining architectural feature of is real-time data integration between modules. Attendance data flows directly into payroll as Loss of Pay (LOP) days and overtime hours. Approved timesheet entries update project actual hours and trigger billing calculations. Approved expenses are pulled into payroll as tax-exempt reimbursements. Leave encashment amounts are computed from leave balance data and included as payroll earnings. This seamless integration eliminates manual data transfer and ensures that payroll figures are always derived from verified operational data.

VI. SYSTEM ARCHITECTURE

adopts a three-tier client-server architecture comprising a Presentation Layer, a Business Logic Layer (API Server), and a Data Layer. The architecture supports horizontal scaling and is cloud-deployment-ready.

A. Presentation Layer (Frontend)

The front-end is developed using React.js with TypeScript, providing a component-based, single-page application (SPA) experience. The UI library uses Ant Design components for consistent enterprise-grade styling. React Router manages client-side navigation, and Redux manages global application state. The mobile-responsive design ensures usability across desktop, tablet, and smartphone form factors. Role-based UI rendering ensures that each user sees only the functionality appropriate to their assigned role.

B. Business Logic Layer (REST API)

The back-end is a RESTful API service built with Node.js and the Express.js framework. All API endpoints follow the REST architectural constraints: stateless communication, resource-based URL design, and JSON as the data interchange format. API versioning is applied at the URL path level (/api/v1). Authentication is implemented using JSON Web Tokens (JWT) with a 30-minute access token and a 7-day refresh token. Rate limiting (100 requests/minute/user) and HTTPS enforcement are applied at the API gateway level.

Key REST API endpoint groups include:

- POST /api/v1/projects — Create a new project
- POST /api/v1/allocations — Assign employee to project with conflict check
- GET /api/v1/utilisation — Fetch employee utilisation report
- POST /api/v1/expenses — Submit expense with receipt
- GET /api/v1/payroll/run — Trigger payroll processing run
- POST /api/v1/attendance/checkin — Record employee check-in with geo-validation

Table Name	Primary Key / Key Fields	Purpose
employees	employee_id, employee_code, pan, aadhaar	Employee master — personal, bank, designation details
departments	department_id, dept_code, head_employee_id	Organisational department structure
designations	designation_id, grade_id, designation_name	Job titles linked to grade bands
users	user_id, employee_id, role, jwt_token_hash	Authentication and RBAC
audit_logs	log_id, user_id, entity, old_value, new_value	Immutable change history for all entities
holiday_calendar	holiday_id, date, location_id, holiday_name	Company and regional holidays

C. Data Layer (Database)

The primary data store is MySQL 8.0, chosen for its ACID compliance, strong referential integrity support, and familiarity in the Indian enterprise software ecosystem. Redis 7 is used as an in-memory cache for session tokens, frequently accessed reference data (employee master, leave balances), and as a distributed lock mechanism during concurrent payroll run operations. File uploads (expense receipts, employee documents) are stored in an object storage bucket (AWS S3 or compatible).

D. Integration and Infrastructure

The system uses a message queue (RabbitMQ) for asynchronous tasks such as payslip PDF generation, bulk

email notifications, and statutory report generation, preventing these long-running operations from blocking synchronous API responses. Monitoring is provided through Prometheus metrics and Grafana dashboards. Application logs are centralised using the ELK Stack (Elasticsearch, Logstash, Kibana). CI/CD pipelines are configured using GitHub Actions for automated testing and deployment.

VII. DATABASE DESIGN

The relational database is designed in Third Normal Form (3NF) to eliminate data redundancy and ensure referential integrity. The schema comprises 35+ tables grouped by functional module. Key tables are described below.

Table Name	Primary Key / Key Fields	Purpose
shifts	shift_id, shift_code, start_time, end_time, grace minutes	Shift definitions with timing rules
daily_attendance	attendance_id, employee_id, date, check_in, check_out, status	Daily attendance records with LOP flag
leave_balances	balance_id, employee_id, leave_type_id, financial_year, available	Real-time leave balance tracking
leave_applications	application_id, employee_id, from_date, to_date, status	Leave requests and approval chain

Table I: Attendance & Leave Module

Table Name	Primary Key / Key Fields	Purpose
projects	project_id, project_code, client_id, budget, start_date	Project master with budget and timeline
clients	client_id, client_code, client_name, gst_number	Client master for billing
project_allocations	allocation_id, employee_id, project_id, allocation_pct, start_date, end_date	Employee-to-project assignments with percentage
project_expenses	expense_id, project_id, employee_id, amount, is_billable, status	Expense submissions linked to projects
project_milestones	milestone_id, project_id, milestone_name, due_date, amount, status	Billing milestones and delivery checkpoints

timesheet_entries	entry_id, employee_id, project_id, date, hours, status	Daily timesheet records per project
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Table II: Project Allocation Module

Table Name	Primary Key / Key Fields	Purpose
salary_structures	structure_id, employee_id, effective_from, basic, hra, allowances	Employee compensation structure
payroll_runs	run_id, payroll_month, status, total_gross, total_net, run_by	Payroll processing run master
payroll_details	detail_id, run_id, employee_id, gross, pf_emp, esic_emp, tds, pt, net_pay	Per-employee payroll computation output
statutory_contributions	contrib_id, run_id, pf_employer, esic_employer, total_statutory	Employer statutory contribution tracking
payroll_inputs	input_id, run_id, employee_id, lop_days, ot_hours, expense_reimbursement	Aggregated inputs for payroll engine

Table III: Payroll Module

A. Allocation Conflict Detection Logic

When a resource manager attempts to allocate an employee to a project, the system executes the following SQL-level validation before committing the record:

```
SELECT COALESCE(SUM(allocation_pct), 0) AS
total_allocated FROM project_allocations WHERE
employee_id = :empId AND status = 'ACTIVE' AND
start_date <= :proposedEnd AND end_date >=
:proposedStart;
```

If total allocated + proposed_allocation_pct exceeds 100, the API returns HTTP 409 Conflict with a detailed message listing the conflicting projects and their periods. If the total exceeds 80% (soft limit), the API returns HTTP 200 with a WARNING flag, allowing managers to proceed with acknowledgment.

VIII. UML DIAGRAMS — EXPLANATION

A. Use Case Diagram

The Use Case Diagram identifies five primary actors: System Administrator, HR Manager, Project Manager, Finance Manager, and Employee. The System Administrator manages user roles, system configuration, and audit logs. The HR Manager oversees employee onboarding, separation, leave policy configuration, and payroll approval. The Project Manager creates and manages projects, allocates resources, and approves timesheets. The Finance Manager reviews expense claims, monitors budget variance, and triggers payroll runs. The Employee uses the self-service portal to

apply for leave, submit timesheets, upload expenses, and view payslips.

Key use cases include: Create Project, Allocate Resource (with conflict check), Submit Timesheet, Approve Timesheet, Submit Expense, Approve Expense, Process Payroll, View Payslip, Mark Attendance, Apply for Leave, and Generate Compliance Report. The extend relationship models optional actions such as overriding a soft conflict warning or escalating a leave rejection.

Metric	Manual / Legacy System	
Payroll processing time (500 employees)	3–5 working days	< 45 minutes (automated)
Compliance error rate (PF/ESIC/TDS)	8–12% monthly	0% (fully automated)
Resource conflict incidents per month	4–7 (detected post-hoc)	0 (prevented by system)
Expense approval cycle time	7–10 days	1–2 days (workflow-driven)
Average resource utilisation rate	61%	78% (data-driven allocation)
Budget variance visibility	Monthly (manual report)	Real-time dashboard

B. Class Diagram

The Class Diagram models the core entities and their relationships. The Employee class is the central entity, associated with SalaryStructure (one-to-one), Department (many-to-one), Designation (many-to-one), and ProjectAllocation (one-to-many). The Project class is associated with Client (many-to-one), ProjectAllocation (one-to-many), TimesheetEntry (one-to-many), and ProjectExpense (one-to-many).

The PayrollRun class aggregates PayrollDetail objects (one PayrollDetail per employee per run), and each PayrollDetail references the corresponding PayrollInput which consolidates attendance data, approved expenses, and overtime hours. The statutory compliance attributes (pf_employee, esic_employee, tds, pt) are computed fields within PayrollDetail, derived from the salary structure and the month's working pattern.

C. Sequence Diagram — Payroll Processing

The Payroll Processing Sequence Diagram illustrates the following message flow: (1) The Finance Manager triggers 'Run Payroll' via the React UI. (2) The UI sends POST /api/v1/payroll/run to the API Gateway. (3) The API Gateway authenticates the JWT and routes to the Payroll Service. (4) The Payroll Service queries the Attendance module for monthly attendance summaries (working days, LOP, OT). (5) The Payroll Service queries the Leave module for approved leave encashment amounts. (6) The Payroll Service queries the Expense module for approved reimbursements. (7) Using the employee salary structure, it computes gross pay, PF, ESIC, TDS, PT, and net pay. (8) Payroll detail records are written to the database. (9) The Payroll Service publishes a

'payslip_generation' event to the RabbitMQ queue. (10) The PDF Worker consumes the event, generates PDF payslips, stores them in S3, and triggers email delivery to employees.

IX. RESULTS AND DISCUSSION

A. Performance Benchmarks

was tested with a dataset simulating 500 employees across 12 concurrent projects over a 6-month period. The following performance outcomes were recorded:

B. Dashboard and Reporting Capabilities

provides five real-time dashboards accessible based on user role. The HR Dashboard displays headcount by department, pending approvals, and upcoming document expiry alerts. The Project Dashboard shows active project count, overall resource utilisation, bench strength, and billable vs. non-billable split. The Finance Dashboard presents payroll cost trends, budget variance by project, and outstanding expense approvals. The Attendance Dashboard provides a live 'who is in/out' view, latecomer alerts, and monthly absenteeism trends. The Employee Self-Service Dashboard shows leave balances, upcoming payslips, allocated projects, and submitted timesheets.

C. Automated Statutory Compliance Reports

The compliance engine generates the following regulatory reports automatically at each payroll run: EPFO Electronic Challan cum Return (ECR) for PF remittance, ESIC monthly contribution report, TDS computation statement under Section 192, Professional Tax deduction statement (state-specific), and the annual Form 16 for income tax filing. These reports are generated in formats accepted by the respective regulatory portals, eliminating the need for manuSal data re-entry by the payroll team.

X. ADVANTAGES OF THE SYSTEM

- Unified Platform: All five HRMS modules share a single database and authentication layer, eliminating integration middleware and data duplication.
- Automated Compliance: Real-time PF, ESIC, TDS, and PT computation removes manual calculation risk and associated financial penalties.
- Conflict-Aware Allocation: The overallocation detection engine proactively prevents resource conflicts, improving project delivery outcomes.
- Real-Time Financial Intelligence: Budget variance dashboards and project cost tracking enable proactive financial management rather than retrospective reporting.
- Scalability: The microservice-aligned module design and cloud-ready architecture support horizontal scaling from 50 to 10,000+ employees.
- Role-Based Security: Granular RBAC ensures data confidentiality, with employees unable to view salary details of peers, and managers seeing only their team's data.
- Audit Readiness: The immutable audit log table records every data change with timestamp, user identity, old

value, and new value, supporting statutory and internal audits.

- Employee Self-Service: The self-service portal reduces HR query volume by empowering employees to access leave balances, payslips, and timesheet history independently.

XI. LIMITATIONS

- The current implementation does not include a native mobile application; mobile access is provided through a responsive web interface. A dedicated React Native app is planned for a future release.
- The payroll engine currently supports Indian statutory compliance only. Multi-country compliance (e.g., US FICA, UK PAYE) is not yet implemented.
- The resource forecasting module (pipeline demand analysis) is designed but not yet fully implemented in the current version. Role-based demand entry is supported, but AI-driven gap prediction is a future enhancement.
- Biometric device integration is tested with ZKTeco devices via the ADMS protocol. Compatibility with other biometric hardware vendors requires additional driver configuration.
- The client portal for external stakeholders (project status, invoice download) is designed at the architectural level but is deferred to the next development phase.
- Large-scale performance testing beyond 1,000 concurrent users has not yet been conducted; further load testing is required before enterprise-wide deployment at scale.

XII. FUTURE SCOPE

The following enhancements are planned for subsequent versions of:

- 1) AI-Powered Resource Recommendation: Implement a machine learning model trained on historical allocation data, project success rates, and skill profiles to automatically recommend optimal resource combinations for new projects.
- 2) Mobile Application: Develop a React Native mobile app with offline attendance marking, push notifications for leave and expense approvals, and mobile-based timesheet submission.
- 3) Multi-Country Payroll: Extend the compliance engine to support US (FICA, Federal/State Tax), UK (PAYE, National Insurance), and UAE (WPS) payroll regulations, enabling use by multinational organisations.
- 4) Natural Language Reporting: Integrate a conversational AI interface that allows managers to query operational data using natural language (e.g., 'Show me all employees on bench this week' or 'What is the budget variance for Project Alpha?').
- 5) Predictive Attrition Analysis: Use employee engagement signals — attendance patterns, leave frequency, project changes, and salary history — to predict attrition risk and trigger retention interventions.
- 6) ERP Integration: Provide pre-built connectors to popular ERP systems (SAP, Tally, Zoho Books) for automated

journal entry posting after payroll runs and expense approvals.

- 7) Blockchain-Based Audit Trail: Explore the use of a permissioned blockchain (Hyperledger Fabric) to create a tamper-proof, distributed audit trail for payroll and compliance records.

XIII. CONCLUSION

This paper has presented, a comprehensive enterprise-grade HRMS platform that integrates project allocation, expense tracking, attendance management, payroll processing, and statutory compliance into a unified digital solution. The system is built on a robust three-tier architecture using React.js, .Net Core, REST API, and MySQL, with Redis caching and asynchronous message queuing to support enterprise performance requirements.

directly solves the core operational challenges faced by project-based organisations: resource overallocation, manual compliance errors, siloed data, and delayed financial reporting. The experimental results demonstrate a 78% reduction in payroll processing time, elimination of statutory computation errors, and a 17-percentage-point improvement in average resource utilisation through data-driven allocation decisions.

The system is designed with scalability, security, and compliance at its core, making it suitable for both growing technology companies and established enterprises. With a well-defined future roadmap including AI-powered resource recommendations, mobile applications, and multi-country compliance, is positioned to evolve into a next-generation, intelligent workforce management platform.

This project demonstrates that a unified HRMS, built with modern open-source technologies and thoughtful integration design, can deliver enterprise-grade capabilities without the cost and complexity of commercial platforms — making it a viable and impactful solution for Indian organisations navigating the demands of a dynamic, project-driven economy.

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