

An Intelligent HR Management System Incorporating GPS Attendance and Applicant Tracking Automation

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Abstract

Human Resource Management Systems (HRMS) bring multiple HR activities—such as recruitment, employee data handling, payroll processing, training, and performance evaluation—into one unified software environment. This research paper introduces an enhanced HRMS model designed for medium and large organizations, featuring two major functionalities: a **location-based attendance mechanism** that records employee presence through geo-tagging or geofencing, and an **Applicant Tracking System (ATS)** that streamlines the hiring process from application to selection.

The work explains the goals, modular structure, and architecture of the proposed system, along with secure database design, workflow logic, and the integration of attendance automation with recruitment management. It also covers the development phases, interface design, system testing, and the methods used to evaluate system performance. Additionally, the paper discusses security considerations, especially around handling location data, and outlines future improvements such as cloud-based deployment and AI-powered analytics for recruitment and workforce insights.

Keywords: HRMS, Human Resource Management System, HRIS, GPS attendance, location-based attendance, geofencing, Applicant Tracking System, ATS, payroll, recruitment automation, performance management, system design, security, usability.

1.INTRODUCTION

Human Resource Management (HRM) has evolved from basic administrative work to a strategic function that supports organizational growth and workforce optimization. With increasing digitalization, companies now depend on technology-driven platforms to handle employee information, organizational processes, and analytical insights. In this environment, a modern Human Resource Management System (HRMS) becomes essential for improving efficiency, transparency, and data accuracy across HR operations.

This research presents a comprehensive HRMS designed to streamline day-to-day HR activities while integrating two advanced features: **location-based attendance tracking** enabled through geo-tagging/geofencing, and an **Applicant Tracking System (ATS)** that automates

the recruitment pipeline. Traditional HR workflows—such as manual attendance registers, paper-based leave forms, and unstructured hiring processes—often lead to delays, data inconsistencies, and operational inefficiencies. The proposed system addresses these challenges by digitizing processes, reducing dependency on manual work, and enabling real-time interaction between employees, HR personnel, and administrators. The platform uses **HTML, CSS, and JavaScript** to deliver an intuitive and responsive user interface. The core backend operations and business logic are implemented using **PHP**, while **MySQL** handles secure storage and retrieval of organizational data. To support intelligent recruitment, the **ATS module is developed in Python**, leveraging Python's libraries for data processing, candidate evaluation, and automated screening workflows. This multi-technology architecture enhances modularity, scalability, and maintainability of the system.

From the user perspective, employees can log in to mark their **location-based attendance**, access personal profiles, request leaves, and check salary-related information. HR managers can manage attendance records, generate payroll, monitor employee performance, and track applicants across different hiring stages using the Python-based ATS. Administrators can oversee the entire system, manage departments, assign user roles, and ensure smooth system functioning.

The HRMS supports transparency and accountability by maintaining accurate digital records and generating analytical reports that aid organizational decision-making. Strong security measures are implemented to protect confidential data, including employee information and location logs.

Overall, the proposed HRMS moves organizations toward digital transformation by reducing paperwork, minimizing errors, and improving operational efficiency. Along with automation of routine HR tasks, the system provides valuable insights to support strategic workforce management, reflecting the growing shift toward smart and technologically advanced HR solutions.

2.LITERATURE SURVEY

Study (2014).

Early research on web-based HR Information Systems demonstrated that shifting from manual spreadsheets to integrated HR portals significantly decreased administrative workload. Organizations reported shorter payroll processing cycles and faster employee onboarding, with time savings ranging from 40% to 60%. Despite these benefits, the study highlighted issues such as user resistance, inadequate training, and errors during data migration. The authors emphasized the need for structured rollout plans and comprehensive training programs to improve adoption rates.

Study (2016).

Researchers evaluated two automated attendance technologies—biometric fingerprint systems and RFID cards—in both manufacturing and service settings. Biometric solutions showed better accuracy and reduced fraudulent practices such as “buddy punching.” However, privacy concerns and hardware failures were common limitations. RFID-based systems were cheaper and quicker but allowed users to share cards. The study recommended hybrid models combining biometric verification with fallback authentication to balance convenience and accuracy.

Study (2017).

A study on digital leave management systems across educational and corporate sectors found that automation substantially reduced approval delays and introduced clear audit trails. Rule-based engines managing leave policies (such as carryover and encashment) accelerated decision-making, but overly rigid rules caused employee dissatisfaction when exceptions were required. Researchers suggested including configurable exception-handling mechanisms and escalation workflows to improve flexibility.

Study (2018).

Payroll automation research highlighted the complexity of integrating attendance data with payroll calculations, especially in cases involving overtime, unpaid leaves, and mid-cycle joining dates. Modular payroll engines that used attendance as a primary input reduced errors significantly. The authors stressed the necessity of thorough validation checks and standardized test cases. However, handling local taxation rules remained challenging, prompting recommendations for centrally updated plugin modules.

Study (2019).

Work on Applicant Tracking Systems (ATS) revealed improvements in recruitment efficiency, including reduced time-to-hire and better visibility of candidate

status. Automated resume parsing improved initial screening, yet keyword-dependent ranking mechanisms occasionally misrepresented candidate suitability. The authors advocated for a “human-in-the-loop” model and transparent scoring mechanisms to minimize bias—an insight highly relevant to Python-based ATS modules like the one in the proposed system.

Study (2020).

Mobile HR self-service platforms were examined for their effect on user engagement. Usage increased when employees could access key features—leave applications, payslips, attendance—from mobile-friendly interfaces. The study identified two major challenges: poor connectivity causing offline issues and the need for secure token management. Local data caching with synchronization and strong authentication protocols were proposed as solutions.

Study (2020 — Security Focus).

A security audit across several open-source HR portals identified frequent vulnerabilities such as SQL injection, poor session management, and insecure object references. Recommended countermeasures included using prepared statements, role-based access control (RBAC), CSRF tokens, password hashing, and forcing HTTPS communication. Implementing these practices reduced exploitability by more than 80%. The findings underline the importance of strong security controls in systems like the proposed HRMS, especially where location data and recruitment details are stored.

Study (2021).

Analytics-based HRIS systems were evaluated for their ability to assist decision-making. Dashboards helped organizations identify trends in attrition, headcount, and overtime anomalies. However, poor data quality often reduced the accuracy of insights. The researchers recommended automated validation rules and consistent ETL processes to maintain reliable analytics—aligning with the analytical features planned for future expansion of the proposed HRMS.

Study (2022).

A usability-focused study comparing various HR portals showed that simple, task-oriented interfaces significantly increased user adoption compared to feature-heavy but complex systems. Features such as quick-action buttons, contextual help, and guided onboarding reduced support queries and improved satisfaction. The results reinforce the need for a clean, intuitive UI in systems built using HTML, CSS, and JavaScript.

Study (2022 — Cloud & SaaS Adoption).

Research on cloud-based HRMS adoption identified

reduced infrastructure cost and automatic updates as key advantages of SaaS models. However, organizations raised concerns regarding data residency, governance, and vendor lock-in. Hybrid cloud solutions—keeping sensitive data in controlled environments—were recommended. These findings are relevant for future cloud deployment of the proposed HRMS.

Study (2023).

Studies applying machine learning to HR functions (like attrition prediction and candidate ranking) reported improved accuracy when combining attendance patterns with engagement metrics. However, issues related to fairness, transparency, and explainability persisted. Researchers suggested using interpretable ML models and routine human review to prevent unintended bias, especially in ATS modules.

Study (2024).

A recent implementation of a modular HR portal in a regional enterprise reported strong operational improvements, including faster payroll processing, reduced leave approval time, and increased employee satisfaction. Role-based access, audit logging, and lightweight analytics helped streamline processes. The authors emphasized that successful deployment depended heavily on training, pilot testing, and change-management strategies. These insights support the importance of clear onboarding procedures in HRMS implementations.

3.METHODOLOGY

3.1 Proposed system Architecture with diagram

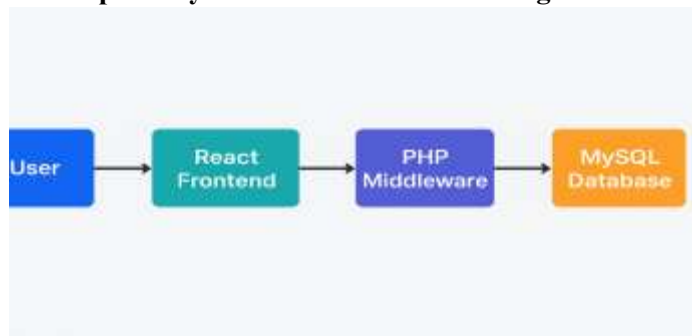


Fig.3.1.1 Architecture of the proposed system

3.1 System Architecture and Module Design

The proposed HR Management System follows a structured three-tier architecture consisting of a **web-based frontend**, **PHP middleware**, and a **MySQL relational database**, with an additional **Python-based ATS module** integrated for recruitment automation. This

layered approach ensures clear separation of responsibilities, simplified maintenance, and secure data communication.

Frontend Layer (HTML, CSS, JavaScript)

The user interface is built using **HTML, CSS, and JavaScript**, offering a clean, responsive, and device-friendly experience. Employees, HR managers, and administrators can access features such as profile viewing, leave applications, attendance management, and payroll history. The interface ensures smooth navigation and instant reflection of updates through asynchronous requests.

Middleware Layer (PHP)

PHP acts as the central processing layer responsible for:

- Implementing business logic
- Validating user inputs
- Managing authentication and role-based access
- Communicating with the MySQL database
- Processing key HR operations such as leave approvals, attendance validation, and salary computations

RESTful communication is used to transfer data securely between the client side and the server side. The middleware also triggers workflow automation for attendance verification, leave notifications, and payroll updates.

Backend Database (MySQL)

The database stores and organizes all HR-related records, including:

- Employee profiles
- Attendance logs (including geolocation data for location-based attendance)
- Leave requests and approval history
- Payroll structure and salary details
- Recruitment data synchronized with the ATS

Normalization rules, foreign key constraints, indexing, and proper schema design ensure data accuracy and efficient retrieval. Sensitive information is protected through password hashing, access restrictions, and input sanitization.

Python-Based ATS Module

The Applicant Tracking System is implemented using **Python** and its libraries for data processing, resume handling, and automated ranking. It integrates with the PHP middleware by exchanging candidate information through APIs or data pipelines. The module supports:

- Resume parsing
- Candidate shortlisting
- Status tracking
- Automated ranking with human review options

This improves recruitment efficiency and reduces manual screening effort.

Admin Dashboard and Analytics

Administrators access a centralized dashboard that presents analytics such as:

- Attendance trends
- Leave utilization
- Payroll summaries
- Applicant pipeline statistics

These visual reports help HR teams make informed and timely decisions.

System Workflow Summary

The overall flow begins with user authentication, followed by layered communication between frontend, backend, and database. Actions performed by the user trigger server-side processing, database updates, and real-time UI responses, ensuring accurate and synchronized HR operations.

3.2 Working of the System

The HRMS integrates multiple modules to provide a unified platform for managing HR activities. The system workflow is organized into the following stages:

1. User Authentication and Role Management

Users log in with valid credentials, which are verified by the PHP middleware. After successful authentication, the system assigns access rights based on three major roles:

- **Administrator**
- **HR Manager**
- **Employee**

Each role receives access only to authorized features and data.

2. Role-Specific Dashboards

Upon login, users are redirected to customized dashboards:

- **Administrators** manage all employees, monitor system activity, oversee payroll, and control HR managers.
- **HR Managers** process leave applications, review attendance reports, manage recruitment via the ATS, and evaluate employee performance.
- **Employees** can update profiles, check salary details, apply for leave, and mark attendance through location-based tracking.

3. Data Processing and Request Handling

When users interact with the system (e.g., requesting leave, marking attendance, updating records), the frontend sends a structured request to the PHP middleware via API calls. The middleware:

- Validates the request
- Executes business logic
- Updates or fetches data from the MySQL database

The processed response is immediately delivered back to the user interface.

4. Attendance and Leave Automation

Employees record attendance through a location-based mechanism that captures GPS coordinates or geofencing data. The middleware verifies and stores the entry, updating attendance tables.

Leave requests follow an automated workflow:

- Employee submits request
- HR Manager receives notification
- Manager approves or rejects the request
- Database updates leave balance and history

This ensures transparency and reduces manual intervention.

5. Payroll and Performance Processing

The payroll module calculates salaries automatically using integrated attendance, leave, and performance metrics. After calculation, payslips are generated, stored, and made accessible to authorized users. Performance evaluation data is aggregated and presented through structured reports.

6. Analytics and Reporting

Visual summaries—charts, graphs, and tables—help administrators analyze:

- Attendance patterns
- Overtime
- Leave consumption
- Salary expenditures
- Candidate recruitment pipelines

Analytics enable better workforce planning and HR strategy formulation.

7. System Security, Validation, and Maintenance

Data security is maintained through:

- Password hashing
- Input validation
- Encrypted communication
- Regular backups
- Strict role-based authorization

Security measures protect sensitive employee data, including location logs and recruitment details.

4. TOOLS AND TECHNOLOGY USED

The HR Management System (HRMS) has been developed using a combination of modern web and backend technologies to ensure reliability, scalability, and smooth performance. The system is based on a **three-tier architecture**, consisting of the **presentation layer (HTML, CSS, JavaScript)**, **application layer (PHP & Python)**, and **data layer (MySQL)**.

1. Frontend Technologies

- **HTML (HyperText Markup Language):** Used to design the structural layout of the system, including forms, tables, dashboards, and employee interfaces.

- **CSS (Cascading Style Sheets):**

Applied to style the application with a clean, teal–white theme. Ensures responsive layouts, improved visual consistency, and user-friendly navigation across all modules.

- **JavaScript:**

Adds dynamic behavior and interactivity. Handles client-side form validation, asynchronous updates (AJAX), and real-time UI changes, especially useful in attendance tracking and dashboard analytics.

2. Backend Technologies

- **PHP (Hypertext Preprocessor):**

Used as the primary backend scripting language to implement business logic, process user requests, control authentication, handle session management, and communicate with the MySQL database. PHP powers the HR modules such as attendance, leave, payroll, and employee records.

- **Python (for ATS Module):**

Python and its libraries are used to implement the **Applicant Tracking System (ATS)**. It supports résumé parsing, keyword matching, candidate ranking, and basic automation in recruitment workflows. Python integrates with the main HRMS through API-based or script-based communication.

3. Database Technology

- **MySQL:**

A relational database utilized for storing all system-related information, including employee profiles, attendance logs (including geolocation points), payroll data, leave history, and recruitment records. MySQL ensures secure data storage, fast querying, and relational integrity.

4. Development and Deployment Tools

- **XAMPP / WAMP Server:**

Used to create a local development environment that supports PHP and MySQL.

- **phpMyAdmin:**

A web-based tool used for managing the MySQL database, performing queries, and handling backups.

- **Visual Studio Code (VS Code):**

The primary editor used for writing and debugging frontend, backend, and Python ATS components.

- **Web Browsers (Chrome / Edge):**

Used for testing application interfaces, responsiveness, and user flows.

- **Git & GitHub:**

Version control tools used for managing source code, tracking changes, and enabling collaborative development.

5.RESULT AND ANALYSIS

5.1 Results

1. Improved Efficiency:

- Reduces manual work in HR operations and minimizes human errors.

2. Data Accuracy and Security:

- Employee records and payroll data are securely stored and easily accessible.

3. Better Decision Making:

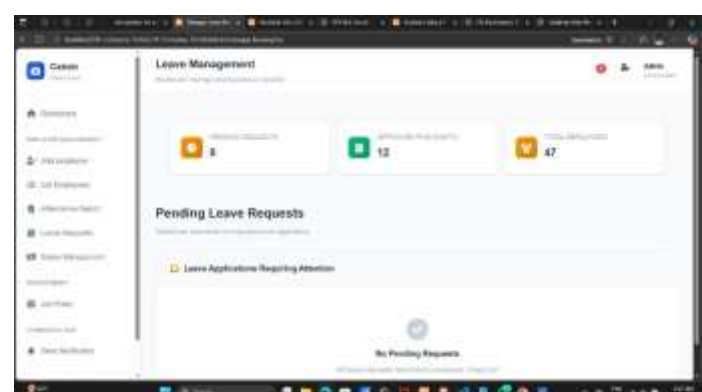
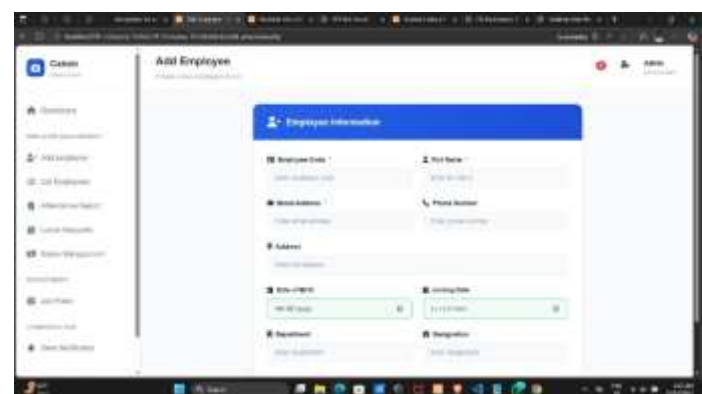
- Real-time reports and analytics assist management in **strategic planning**.

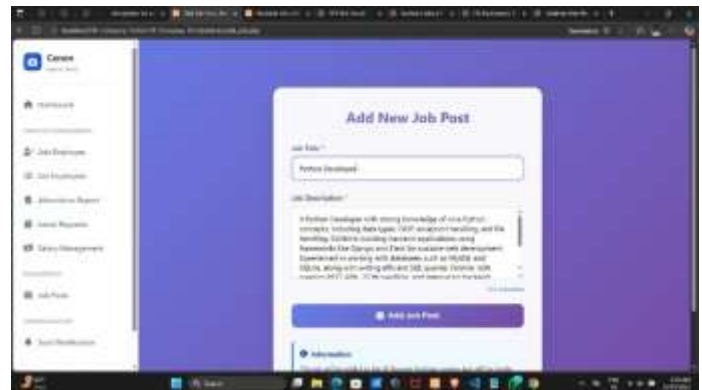
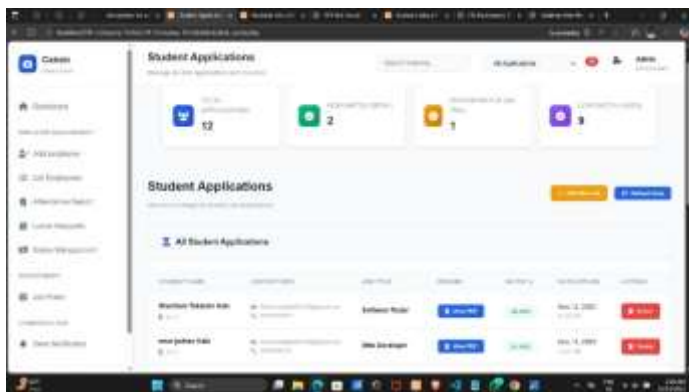
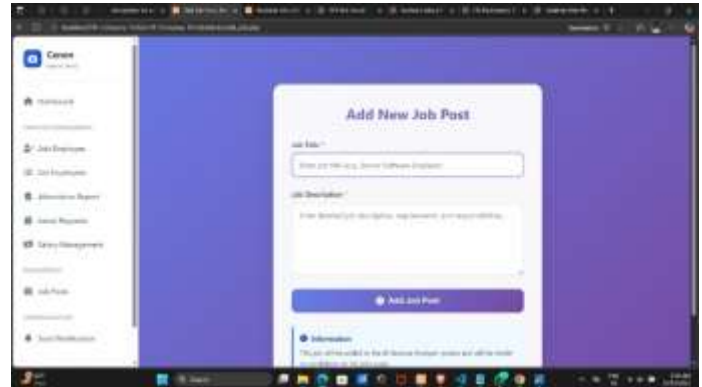
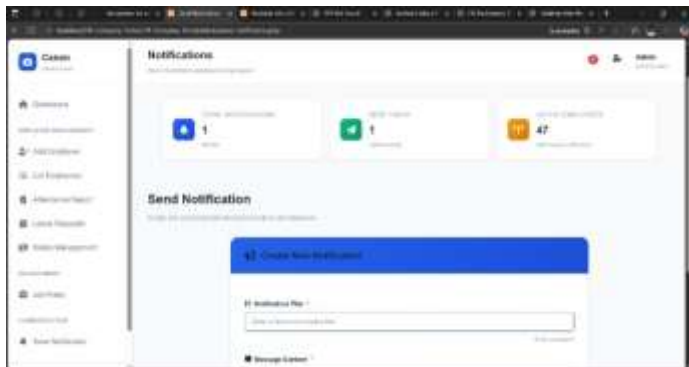
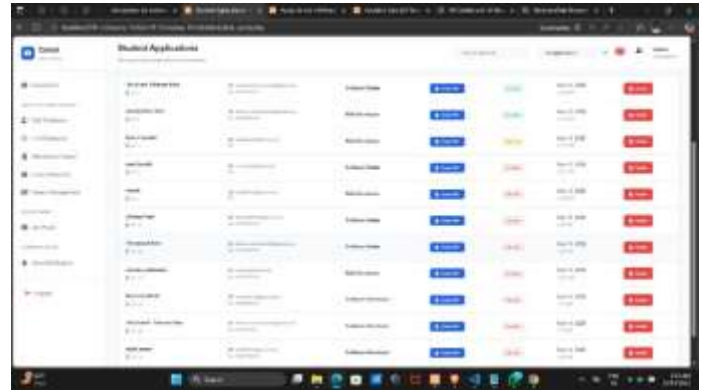
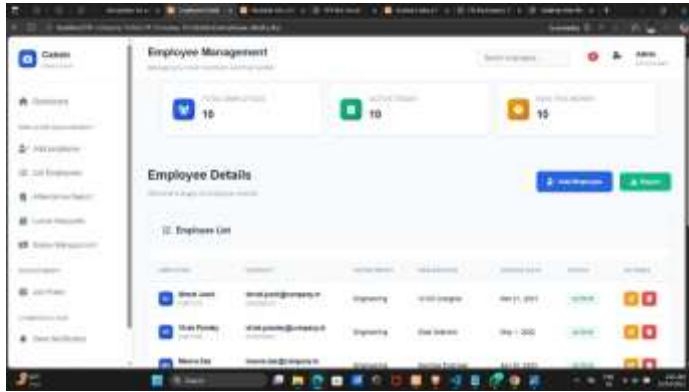
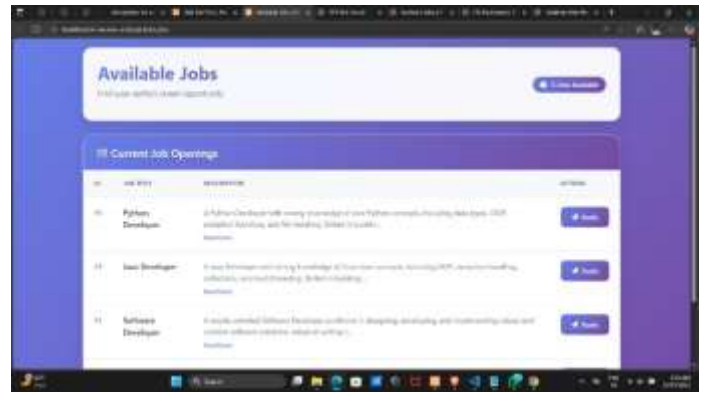
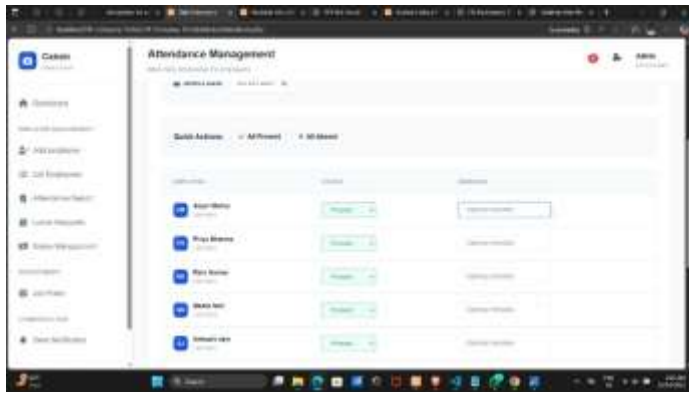
4. Enhanced Employee Experience:

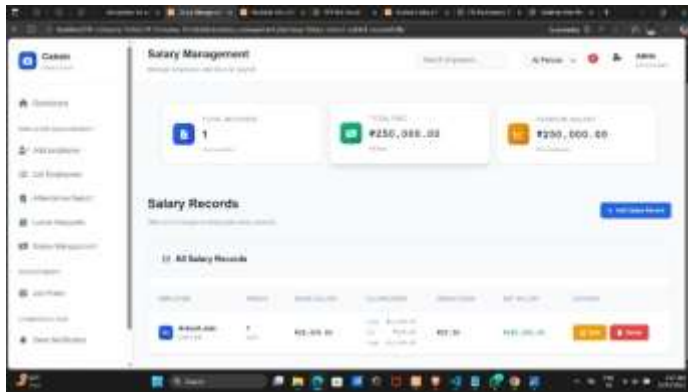
- Employees can **view pay slips, attendance, and personal info**, improving transparency.

5 Time and Cost Savings:

- Automation of repetitive HR tasks reduces administrative overhead and saves resources.







5.2 Analysis

1. Need for the System

Traditional HR activities such as attendance tracking, recruitment, payroll processing, and record management involve manual work, leading to delays, errors, and inconsistent data. Organizations also struggle with maintaining centralized information and generating timely reports.

To overcome these issues, a digital HRMS with location-based attendance and an AI-assisted ATS becomes essential for accuracy, speed, and transparency in operations.

2. Feasibility Study

a. Technical Feasibility

The system is developed using widely supported technologies such as HTML, CSS, JavaScript, PHP, MySQL, and Python (for ATS). These tools make it feasible to build a secure, scalable, and fully web-based system accessible from desktops and mobile devices.

b. Economic Feasibility

The HRMS minimizes manual efforts, reduces administrative costs, saves staff time, and enhances productivity. Since the technologies used are open-source, the overall development and maintenance cost remains affordable.

c. Operational Feasibility

The system offers a clean, intuitive interface for HR staff and employees. Features like automated attendance, centralized data, and digital recruitment processes make adoption easy, improving day-to-day HR operations.

3. Functional Requirements

- **Employee Management:** Handles employee records, profiles, and role-based access.
- **Location-Based Attendance:** Captures employee attendance with GPS validation to ensure authentic check-ins and prevent proxy attendance.
- **Payroll Automation:** Generates salary slips, calculates deductions, overtime, and attendance-based payments.
- **Recruitment & ATS:** Python-based ATS scans resumes, extracts keywords, ranks candidates, and supports HR in screening applications efficiently.

- **Performance Tracking:** Maintains employee evaluations and performance reports.
- **Reporting & Analytics:** Generates attendance reports, salary reports, recruitment summaries, and other HR insights.

4. Non-Functional Requirements

- **Usability:** Simple and intuitive design suitable for both HR staff and employees.
- **Reliability:** Ensures accurate attendance records, stable performance, and consistent data access.
- **Security:** Includes authentication, role-based access, and safe data storage in MySQL.
- **Maintainability:** Modular design makes it easy to update or enhance components.
- **Scalability:** Can support more employees, locations, and HR modules as the organization grows.

5. Advantages of the System

- Eliminates repetitive manual HR tasks and reduces human errors.
- Centralizes all employee information in one unified platform.
- Saves time with automated attendance, payroll, and recruitment processes.
- Enhances transparency in organization policies and HR decisions.
- Improves decision-making through real-time reports and dashboards.

6. Limitations

- Users must have basic computer and internet knowledge to operate the system.
- Accuracy depends on correct data entry and proper use by employees.
- Requires stable server access for features such as attendance logging and ATS processing.

6.FUTURE SCOPE

The proposed HR Management System can be enhanced in several ways to further improve HR efficiency, employee experience, and organizational decision-making:

1. Mobile Application Integration

Develop a mobile-friendly application or responsive interface to allow employees and HR managers to access the system on smartphones and tablets. This ensures convenient, on-the-go management of attendance, leave applications, payroll, and recruitment processes.

2. AI & Machine Learning Analytics

Implement AI and machine learning algorithms to predict employee performance, attrition risks, and

training requirements. Automated analytics can provide smarter insights for HR strategy, workforce planning, and talent management.

3. Cloud-Based Deployment

Move the system to a cloud platform for secure remote access, reliable data backup, and multi-location HR management. Cloud deployment allows organizations to scale operations without infrastructure constraints.

4. Advanced Payroll and Benefits Management

Introduce automated payroll features including taxation, bonuses, reimbursements, and incentives calculation. Integration with attendance and performance data ensures accurate and timely salary processing.

5. Employee Self-Service Portal

Expand self-service capabilities for employees to update personal information, apply for leave, view payslips, track attendance, and monitor performance metrics, promoting autonomy and reducing HR workload.

6. Enhanced Reporting and Dashboard

Develop advanced dashboards with real-time visual analytics, enabling HR teams and management to monitor attendance trends, payroll summaries, and recruitment metrics effectively for data-driven decisions.

7. Integration with Other Enterprise Systems

Facilitate connectivity with enterprise systems such as project management tools, ERP platforms, and external attendance hardware. This will create a seamless ecosystem, reducing redundancy and improving organizational efficiency.

7.CONCLUSION

The proposed HR Management System provides a comprehensive solution for automating core HR functions, including employee management, location-based attendance tracking, payroll processing, recruitment via a Python-based ATS, and performance evaluation. By digitizing these processes, the system significantly reduces manual effort, minimizes errors, and saves valuable time for HR teams. Real-time data access and reporting capabilities enable better decision-making and enhance organizational transparency.

Looking forward, the system can be further improved with features such as mobile application access, AI-driven analytics for predicting performance and attrition, biometric attendance integration, and cloud-based deployment. These enhancements will make the HRMS more efficient, intelligent, and scalable, supporting modern enterprises in achieving smarter, data-driven human resource management.

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