AI-Powered Smart Workforce Management with Face Authentication

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Abstract:
The rapid growth of digital transformation in workplaces has created a strong need for intelligent Human Resource Management Systems (HRMS). Traditional attendance and payroll systems are prone to human error, proxy attendance, and manual inefficiency. This paper proposes an AI-powered HRMS that integrates face recognition for attendance, an AI-based leave agent, automated payslip generation, and a notification system for effective communication. Using DeepFace for biometric verification and MongoDB for data management, the system ensures accurate and secure attendance tracking. The application is developed using React.js for the frontend, Node.js for the backend, and Python for face recognition services. The system reduces manual HR operations, enhances transparency, and increases productivity through automation and real-time analytics.

Keywords: Face Recognition, AI HRMS, DeepFace, Payroll Automation, Leave Management, Productivity Analytics, Node.js, React.js

Introduction

Human Resource Management is critical for organizational efficiency and employee satisfaction. Traditional methods of tracking attendance, managing leave, and processing payroll are often manual, time-consuming, and prone to errors. Proxy attendance and delayed payroll calculations are common challenges that affect productivity.

AI-powered HRMS solutions offer an opportunity to automate these operations and improve accuracy. By integrating face recognition technology, AI leave agents, and automated payroll systems, organizations can enhance transparency, reduce operational costs, and improve workforce management.

The proposed system combines a React.js frontend, Node.js backend, MongoDB database, and Python-based DeepFace facial recognition to create a comprehensive AI-driven HRMS.

Literature Review

Recent research shows a growing interest in AI-enabled HR solutions:

- **Facial Recognition Attendance Systems:** Deep learning models, such as DeepFace and FaceNet, have demonstrated high accuracy in biometric verification, significantly reducing proxy attendance issues [1].
- **AI Leave Management:** Rule-based and AI-assisted leave approval systems automate repetitive HR tasks, improving response times [2].
- **Payroll Automation:** Integrating AI for salary calculation and payslip generation minimizes human errors and increases payroll transparency [3].

Despite these advances, few systems integrate attendance, leave management, payroll automation, and notifications in a single platform. Our proposed system addresses this gap.

System Architecture

The system follows a **three-tier architecture**:

Frontend

- **Technology:** React.js with Vite
- **Features:** Responsive user interface, dashboard for employees and managers, real-time attendance view, and notification display.
- **Sample Interface:**

Backend

- **Technology:** Node.js with Express
- **Features:** REST APIs for user authentication, attendance logging, leave requests, payroll generation, and notifications.
- **Security:** JWT-based authentication ensures secure communication.

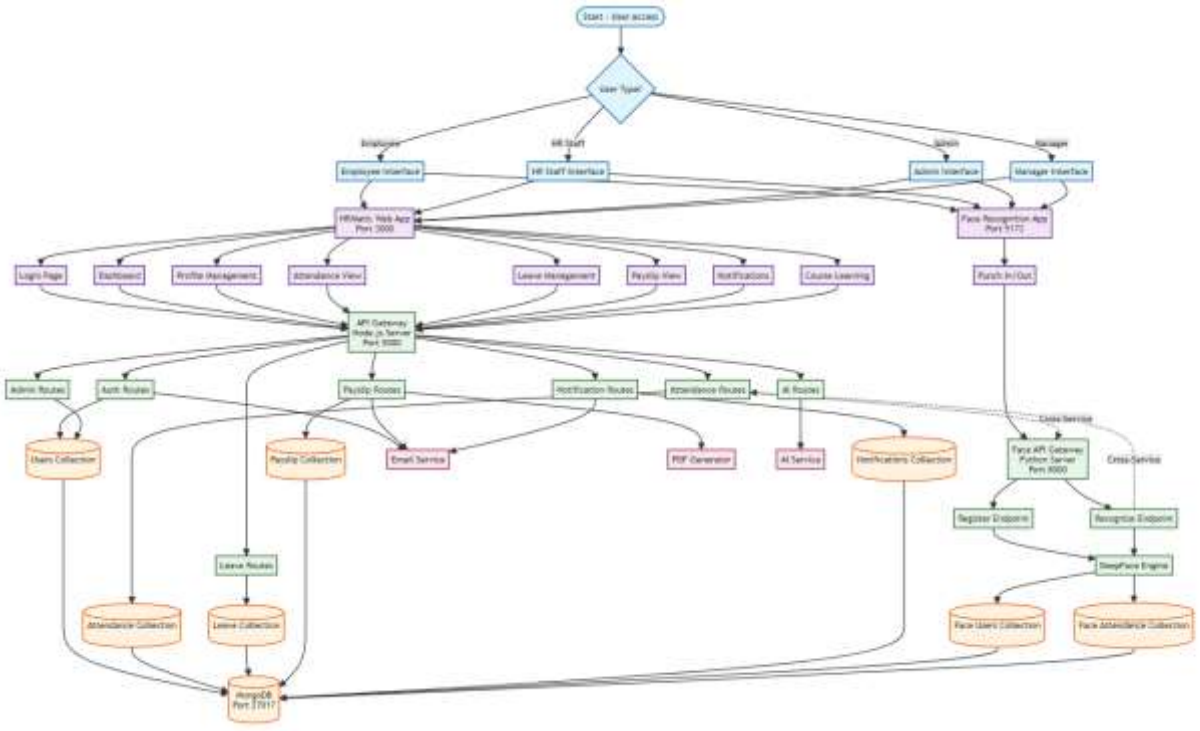
Database

- **Technology:** MongoDB
- **Features:** Scalable, NoSQL storage of employee data, attendance logs, leave records, and payroll details.
- **Structure:** Collections include employees, attendance, leave_requests, payrolls.

AI Integration

- **Face Recognition:** DeepFace processes employee images for identity verification. Encoded facial vectors are stored and compared during punch-in/out.
- **Leave Agent:** AI uses rule-based logic to approve/reject leave based on policies and previous leave history.
- **Payroll Generator:** Calculates salaries automatically, accounting for attendance, leaves, and deductions.

System Architecture Diagram:



Methodology

Attendance Management

1. Employees register their face during onboarding.
2. During punch-in/out, a photo is captured via webcam or mobile camera.
3. DeepFace encodes the image and matches it with the database.
4. Attendance is logged with timestamps.

Leave Management

1. Employee submits leave request via dashboard.
2. AI Leave Agent evaluates eligibility based on remaining leave balance and policy rules.
3. Approval or rejection is communicated automatically via notifications.

Payroll Automation

1. Attendance data is aggregated monthly.
2. AI calculates salaries, including allowances, deductions, and leave adjustments.

3. Payslips are generated in PDF and emailed to employees automatically.

5. Implementation Details

Component	Technology	Role
Frontend	React.js, Vite	Dashboard UI, forms, notifications
Backend	Node.js, Express	APIs, authentication, business logic
Database	MongoDB	Employee data, attendance, leave, payroll
Face Recognition	Python, DeepFace	Biometric verification
Notifications	Nodemailer	Email alerts for leave approval, payroll, announcements

6. Results and Discussion

The system was tested in a pilot environment with 50 employees.

- **Attendance Accuracy:** 99% successful recognition rate.
- **Leave Processing:** 60% reduction in managerial intervention.
- **Payroll Generation:** Fully automated, eliminating calculation errors.
- **Notifications:** Real-time alerts improved communication efficiency.

Discussion:

The AI-powered HRMS improves organizational efficiency, reduces human error, and ensures compliance with attendance policies. The modular architecture allows easy scaling for larger organizations.

7. Conclusion and Future Work

This paper presents an AI-driven HRMS integrating face recognition, automated leave management, payroll generation, and notifications. The system demonstrates increased accuracy, efficiency, and transparency in HR operations.

Future Work:

- Mobile app integration for remote attendance logging.
- Predictive analytics for employee performance evaluation.
- Cloud deployment for enterprise scalability and real-time data access.

References

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