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Design and Implementation of a Web-Based ERP System for Academic Management in the ENTC Department

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Abstract–*Modern educational departments face significant challenges in managing voluminous academic data, including student records, faculty workloads, and attendance tracking. Traditional manual record-keeping leads to data redundancy and administrative delays. This paper presents a comprehensive web-based Enterprise Resource Planning (ERP) system specifically tailored for the Electronics and Telecommunication Department. The system integrates core modules such as a Resume Analyzer, Attendance Tracker, Course Management, and Submission Tracker into a unified platform. Developed using a robust tech stack including Django/PHP and MySQL, the system employs role-based access control to ensure data security and real-time synchronization. Experimental objectives focus on eliminating data silos and enhancing departmental transparency. The proposed framework demonstrates how digitizing routine academic workflows can improve operational efficiency and provide actionable insights for both faculty and students.*

Key Words: **Enterprise Resource Planning (ERP), Academic Management, Resume Analyzer, Attendance Tracking, Web based Systems, ENTC Department**

1. INTRODUCTION

In the era of Industry 4.0 and Smart Campuses, managing departmental functions efficiently has become increasingly complex. The Department of Electronics and Telecommunications (ENTC) manages a wide range of data related to students, faculty, and academic assessments. Traditional methods often rely on manual registers or disconnected spreadsheets, leading to lack of synchronization and delayed decision-making.

1.1 A need of Centralization

As the volume of academic data grows, the need for a unified platform to automate operations becomes crucial. Fragmented systems result in data inconsistency and difficulty in tracking real-time performance. The proposed ERP system addresses these issues by providing a single platform for all departmental activities.

1.2 Enhancing Student and Faculty Coordination

The primary objective is to streamline routine workflows such as attendance and submission tracking—to reduce paperwork and enhance productivity. By automating these processes, the department can ensure transparency and accountability among all stakeholders

2. EASE OF USE

2.1 Limitations of Traditional Systems

Earlier organizational management systems primarily relied on standalone software applications designed to handle specific functional areas such as payroll processing, inventory management, or student record maintenance. Although these systems were effective within their limited scope, they operated independently and lacked interoperability. As a result, organizations frequently encountered issues related to redundant data entry, data inconsistency, and fragmented information storage. The absence of integration between modules made it difficult to generate comprehensive reports or gain a unified view of operations, ultimately reducing efficiency and increasing administrative overhead.

Moreover, maintaining multiple isolated systems required additional technical resources, separate maintenance efforts, and repeated validation processes. This not only increased operational costs but also heightened the risk of human error and data discrepancies across departments. Decision-making was often delayed due to the time required to manually consolidate data from various sources.

While comprehensive commercial Enterprise Resource Planning (ERP) solutions such as SAP and Oracle provide integrated, enterprise-level functionalities, they are typically designed for large-scale organizations with substantial financial and technical resources. For individual academic departments, these solutions are often excessively complex, costly to implement, and resource-intensive to maintain. The high licensing fees, infrastructure requirements, and customization costs make them impractical for smaller institutions or department level deployment. Consequently, there exists a clear need for a streamlined, cost-effective, and customizable ERP solution tailored specifically to the operational requirements of academic departments.

2.2 Evolution of Web-Based ERP

Recent studies emphasize the growing effectiveness of web-based ERP prototypes developed using technologies such as PHP and MySQL for academic institutions. These platforms provide a lightweight, scalable, and cost-efficient alternative to traditional enterprise-level systems. The adoption of web-based architectures enables centralized data management, remote accessibility, and real-time synchronization across multiple user roles, including administrators, faculty members, and students. Such systems significantly reduce dependency on standalone desktop applications and manual record-keeping processes, thereby enhancing operational efficiency.

Researchers have also proposed modular ERP frameworks that prioritize flexibility, user adaptability, and incremental deployment. Instead of implementing a monolithic system, modular designs allow institutions to integrate functional components based on specific departmental requirements. This approach not only lowers implementation costs but also simplifies maintenance and future upgrades. By focusing on intuitive user interfaces and streamlined workflows, these frameworks ensure higher acceptance rates among non-technical users within academic environments.

The proposed system builds upon these foundational concepts by integrating department-specific modules tailored to the needs of the Electronics and Telecommunication Department. In addition to core administrative functionalities, it incorporates specialized components such as a Resume Analyzer, Attendance Tracker, and Submission Monitoring system. The inclusion of a Resume Analyzer module extends the scope of traditional ERP systems beyond record management, directly supporting student career development and placement readiness. By combining modular design principles with web-based technologies, the system achieves a balance between affordability, adaptability, and functional depth, making it well-suited for department-level academic management.

3. SYSTEM ARCHITECTURE

The ERP system is designed using a modular, layered approach to ensure scalability and ease of maintenance.

3.1 Presentation Layer

The Presentation Layer acts as the primary interface between the users and the ERP system. It provides a responsive and user-friendly web environment that enables seamless interaction for Students, Faculty members, and Administrators. Designed using modern front-end technologies, this layer ensures cross-platform compatibility and accessibility across desktops, tablets, and mobile devices. The interface dynamically adapts based on user roles, presenting personalized dashboards that display relevant information such as attendance summaries, course details, submission deadlines, and administrative reports. Emphasis is placed on intuitive navigation, minimal learning curve, and clear data visualization to enhance user experience. By offering real-time updates and structured layouts, the presentation layer ensures transparency, usability, and efficient communication within the department.

3.2 Middleware and Core Modules

The middleware layer acts as the communication bridge between the user interface and the centralized database. It is responsible for handling authentication, authorization, and secure data flow across the system. Through role-based access control (RBAC), the middleware ensures that users such as administrators, faculty members, and students can only access functionalities and data relevant to their designated roles. This enhances system security, prevents unauthorized modifications, and maintains data confidentiality. The core modules of the system are designed to streamline academic and administrative operations. These include:

- **Student and Faculty Records**: This module provides centralized management of personal, academic, and professional information. It stores student details such as enrollment data, academic history, and contact information, while faculty profiles include qualifications, department details, and assigned courses. By maintaining updated records in a unified database, the system ensures data consistency and easy retrieval.
- **Attendance Tracker**: The attendance module automates the process of marking, storing, and analyzing attendance data. Faculty members can record attendance digitally, and the system automatically calculates attendance percentages based on predefined criteria. This reduces manual effort, minimizes errors, and provides real-time attendance insights to both students and administrators.
- **Resume Analyzer**: This module leverages keyword matching algorithms to evaluate student resumes against industry-relevant criteria. By comparing resume content with predefined skill sets and job requirements, the system generates feedback and readiness scores. This helps students identify skill gaps and improve employability prospects.
- **Submission Tracker**: The submission tracking module monitors assignment deadlines and manages student submissions efficiently. It records submission timestamps, flags late entries, and provides status updates to both faculty and students. This ensures accountability, promotes timely task completion, and simplifies evaluation workflows.

3.3 Database Layer

A centralized MySQL/SQLite database plays a crucial role in maintaining efficient data management within an integrated system. By storing all application data in a single, unified repository, it eliminates unnecessary data redundancy that typically arises when multiple modules

maintain separate copies of the same information. Reducing duplication not only saves storage space but also minimizes inconsistencies caused by unsynchronized updates.

Furthermore, a centralized database ensures data integrity across all modules by enforcing constraints such as primary keys, foreign keys, unique constraints, and transactional consistency (ACID properties). These mechanisms guarantee that data remains accurate, consistent, and reliable even when accessed or modified simultaneously by different components of the system. As a result, all modules operate on the same real-time dataset, ensuring uniformity, improving reliability, simplifying maintenance, and enhancing overall system performance.

Table -1: System Architecture Overview

Main Component	Subcomponent	Details
Presentation Layer	Interface	Responsive Web Interface
	Access Structure	User Roles
Middleware	Security	Authentication
	Authorization	Role-Based Access Control
Database Layer	Database Engine	MySQL
	Database Engine	SQLite
	Database Engine	Data Integrity

4. METHODOLOGY

4.1 Tech Stack

The proposed system is built using a modern and efficient technology stack that ensures scalability, security, and ease of maintenance. Operations, ultimately reducing efficiency and increasing administrative overhead.

- **Front-End**: HTML, CSS, JavaScript, and Figma for UI/UX Design The front-end layer is developed using HTML for structuring web pages, CSS for styling and responsive layout design, and JavaScript for adding interactivity and dynamic behavior. These technologies collectively ensure a user-friendly and responsive interface across devices. Figma is used during the design phase to create wire frames, prototypes, and intuitive UI/UX layouts before implementation. This helps in visualizing user workflows and improving usability.
- **Back-End**: Django (Python) or PHP for Server-Side Logic Handling The back-end is responsible for implementing business logic, processing user requests, and managing communication between the front-end and the database. Django, a high-level Python framework, provides built-in security features, ORM support, and rapid development capabilities. Alternatively, PHP can be used for server-side script ing to handle form submissions, session management, and data validation. Both options ensure robust performance and secure handling of application logic.
- **Database**: MySQL or SQLite for Secure Data Storage The database layer utilizes MySQL or SQLite to store and manage structured data securely. These relational database management systems support data integrity through constraints, indexing, and transactional control. MySQL is suitable for large-scale deployments requiring multi-user access, while SQLite is ideal for lightweight or prototype implementations. Both options ensure reliable and consistent data storage

4.2 Operational Algorithm

The operational workflow of the system follows a structured algorithm to ensure secure access, efficient processing, and automated reporting.

- **Authentication**: When a user attempts to log in, the system validates the entered credentials against the stored records in the database. Upon successful verification, the middleware determines the user's access level (Administrator, Faculty, or Student) based on predefined role assignments.
- **Dashboard Redirection**: After authentication, the system automatically redirects the user to a role-specific dashboard. Each dashboard displays features and controls relevant to that user category, ensuring clarity and restricted access to sensitive information.
- **Data Interaction (CRUD Operations)**: Users can perform Create, Read, Update, and Delete (CRUD) operations according to their access permissions. For example, administrators may manage records, faculty can update attendance and assignments, and students can view academic information. Access control mechanisms ensure that no unauthorized modifications occur.
- **Automation**: The system incorporates automated processes to generate attendance summaries, performance reports, and other academic analytics. These reports are calculated dynamically using stored data and predefined evaluation criteria, reducing manual workload and improving decision making efficiency.

4.3 Functional Module Performance

- **Attendance and Submission Tracking**: The automation of attendance marking and submission monitoring resulted in a marked reduction in manual paperwork. The system's ability to perform automated percentage

calculations and track deadlines in real-time provides a level of transparency and accountability for both students and faculty that was previously unattainable.

- **Resume Analyzer**: The logic-based keyword-matching mechanism was tested against standard student profiles. The module provided instant feedback based on predefined industry criteria, significantly aiding students in their placement preparation and bridging the gap between academic records and professional readiness.
- **Role-Based Accessibility**: Verification of the authentication module confirmed that role-based dashboards effectively restricted data access. Admin, faculty, and student users were successfully directed to their respective interfaces, ensuring that sensitive academic and personal information remained secure and consistent

5. FEATURES AND EXPECTED OUTCOMES

5.1 Key Functional Modules

- **Course Management**: The system efficiently manages subjects, syllabus details, and faculty allocations. Administrators can update course structures, assign instructors to specific subjects, and maintain organized academic records. This ensures smooth coordination between departments and reduces manual documentation errors.
- **Placement Support**: The Resume Analyzer assists stu dents in preparing for campus placements by providing structured feedback on their resumes. It evaluates format ting, skills, keywords, and overall presentation, helping students improve their profiles and increase their chances of selection.
- **Real-Time Tracking**: Faculty members can monitor at tendance, assignment submissions, and student progress in real-time. This significantly reduces manual workload, improves transparency, and enables quicker academic interventions when necessary.
- **New Method of Counting**: The system introduces an innovative counting mechanism to improve accuracy in tracking attendance, submissions, and performance metrics. This new method minimizes calculation errors,

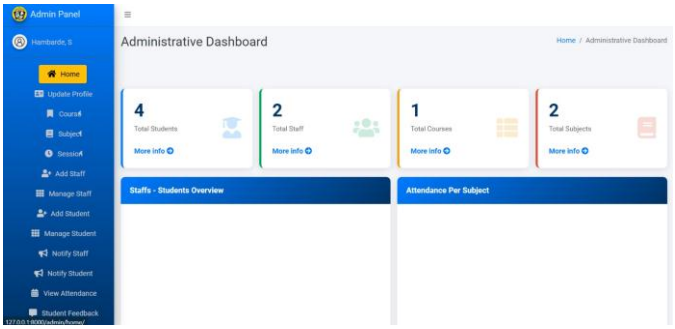

Fig -1: Admin Panel

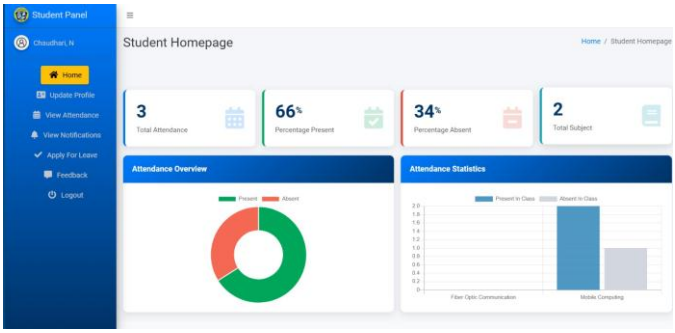

Fig - 2: Student Panel

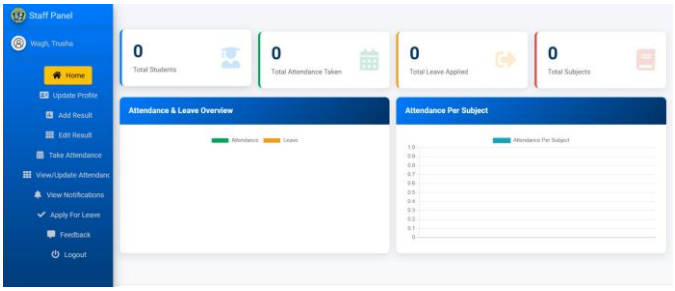

Fig - 3: Teacher Panel

5.2 Expected Outcome

The implementation is expected to significantly improve departmental organization. Students benefit from easy access to records, while administrators gain better control over depart mental data and reporting. In the current industrial landscape, organizations are increasingly adopting digital transformation strategies to stay competitive. ERP systems have become in dispensable as they integrate core functions into a unified plat form, eliminating data silos and facilitating real-time decision making. Agility, transparency, and efficiency are qualities that ERP systems directly support. From an academic perspective, implementing an ERP project helps students understand real world business processes and how technology drives industrial growth.

6. CONCLUSION AND FUTURE WORK

This study demonstrates that a department-specific ERP system is an essential tool for modernizing academic management. By integrating diverse functions like resume analysis and attendance tracking, the system optimizes

resources and improves productivity. Future work will focus on integrating AI-driven analytics dashboards and linking the system with university-wide portals for seamless data exchange. This study demonstrates that a department-specific Enterprise Resource Planning (ERP) system serves as a critical enabler for modernizing academic administration and streamlining departmental operations. By consolidating diverse functionalities—such as resume analysis, attendance tracking, academic record management, and user role administration—into a unified platform, the system significantly enhances operational efficiency and reduces manual workload. The integration of these modules eliminates data silos, improves inter-departmental coordination, and ensures consistent information flow across stakeholders, including faculty, administrators, and students. Furthermore, the automation of routine processes minimizes human error, optimizes resource utilization, and accelerates decision-making through real-time data availability. The centralized architecture supports structured data management, secure access control, and scalable deployment, making it adaptable to evolving institutional requirements. As a result, the ERP system not only improves productivity but also establishes a transparent and accountable administrative framework. Future enhancements will focus on incorporating AI-driven analytics dashboards capable of generating predictive insights, performance metrics, and trend analysis to support strategic planning. Additionally, integration with university-wide portals and external academic systems will be prioritized to enable seamless data exchange, interoperability, and unified institutional reporting. These advancements aim to transform the system into a comprehensive, intelligent academic management ecosystem aligned with the demands of digital transformation in higher education.

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