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Intelligent Elective Subject Selection System

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Abstract: *Elective subject selection in educational institutions is an important process that affects student's academic growth and teacher`s workload. Unfortunately, most institutions still handle this process manually with paperwork. This method is slow, prone to mistakes, and lacks transparency. Students often get confused about which electives are available and which teachers are assigned to them. Meanwhile, teachers have a hard time with scheduling, sharing study materials, and tracking student requests. Heads of Departments and Principals also struggle to manage approvals, coordinate subject assignments, and monitor performance effectively.*

To solve these problems, the proposed system offers a centralized digital platform that connects Principals, Heads of Departments, Teachers, and Students in one place. The system automates important tasks such as student registration, elective subject selection, teacher approval, test scheduling, distribution of study materials, and performance tracking. It ensures accuracy, cuts down on delays, and removes the need for paperwork while providing full transparency. By digitizing the whole process, the system improves efficiency, accountability, and speeds up decision-making, benefiting both administrative workflow and the overall student experience.

Keywords: Academic Transparency, Centralized Platform, Elective Subject Selection, Digital Education System, Student Management, Teacher Approval

I. INTRODUCTION

Education today is changing quickly due to the ongoing use of new technologies, varied curriculum designs, and a stronger focus on student-centered learning. Among the many aspects of academic planning, the process of choosing elective subjects is crucial in shaping students' academic paths. It allows them to select courses based on their interests, career goals, and skills they wish to develop. Elective subjects offer flexibility, encourage interdisciplinary learning, and improve students' chances of employment by letting them explore areas outside their core subjects. Despite its importance, many schools still use outdated methods like paperwork, noticeboards, and in-person approval processes to handle elective subject selection. This traditional approach often leads to various problems, including processing delays, data entry mistakes, communication issues among departments, and a lack of clarity throughout the process. Students often feel confused and dissatisfied because they don't have complete information about the available electives, eligibility requirements, or the teachers for specific courses. Meanwhile, teachers struggle with repetitive tasks like approving student requests, distributing study materials, scheduling tests, and assessing student performance without a unified digital platform. Administrators, including Principals and Heads of Departments, face extra challenges in overseeing the elective selection process, managing approvals effectively, keeping accurate records, and generating performance reports. As the number of students and departments grows, managing these tasks manually becomes more complicated and takes up a lot of time. The absence of a combined digital system affects both the efficiency of the administrative workflow and the academic experience for students and teachers.

To tackle these issues, there is an urgent need for a centralized digital system that can streamline and automate the entire elective subject selection process. This system should bring together all stakeholders—Principals, HODs, Teachers, and Students—on a single digital platform that ensures coordination, transparency, and accountability. The proposed system would automate essential tasks such as student registration, elective selection, teacher approval, test scheduling, and performance tracking, greatly reducing manual work and the chances of error. It would also help teachers share study materials easily, track student progress, and organize their schedules more efficiently.

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Administrators would have access to real-time dashboards that provide insights into student participation, subject demand, and overall departmental performance, aiding in better decision-making and planning. The centralized digital platform would also allow for growth, making it suitable for schools with large student bodies and multiple departments.

By implementing such a smart and automated system, educational institutions can transform the management of electives. It would remove the inefficiencies of old manual methods, improve communication among stakeholders, and ensure total transparency in the approval and allocation process. This digital change not only boosts operational efficiency but also encourages academic excellence by giving students informed choices and allowing teachers and administrators to focus more on providing quality education instead of handling administrative tasks. Ultimately, a centralized elective management system leads to a more efficient, transparent, and student-focused educational environment, enhancing the overall academic experience and school productivity.

II. LITERATURE SURVEY

Recent research papers have looked into combining digital platforms, automation, and federated learning to improve efficiency, privacy, and scalability in data-driven systems. These studies show how new technologies can change traditional manual processes into smart, clear, and secure digital frameworks.

[1] W. Yuan et al. (2023) conducted a study titled Interaction-Level Membership Inference Attack Against Federated Recommender Systems. This study looked into privacy issues in federated recommender systems. It was the first to point out interaction-level threats. This highlights the need for better data protection and defense methods in federated learning settings.

[2]. Mr.ChetanNer et al. (2023) proposed an Agriculture Equipment Rental System that connects equipment owners and farmers through a centralized digital platform. The system improved transparency, accessibility, and operational efficiency by using automation. It shows how digital platforms can make management processes easier. This approach can also be applied to educational systems.Title and Author Details.

[3].Wu et al. (2021) conducted a study on representing long-range context for graph neural networks using global attention. This method improved graph-based learning models by adding global attention mechanisms. It significantly boosted performance for large-scale and complex datasets

[4]. Wu et al. (2021) presented FedGNN: Federated Graph Neural Network for Privacy-Preserving Recommendation, a framework that combines federated learning and graph neural networks to ensure privacy while maintaining recommendation accuracy. This work extended federated learning applications to graph-based and networked data systems.

[5]. H Gao et al. (2021) proposed a Structure Constraint Matrix Factorization Framework for Human Behavior Segmentation. They introduced a model with structure constraints that achieved higher segmentation accuracy and robustness. This approach showed the potential of matrix factorization for analytical and collaborative systems.

TABLE I: LITERATURE SURVEY

Sr. No.	Paper Title	Author(s)	Year	Pros / Key Contributions
1	Interaction-Level Membership Inference Attack Against Federated Recommender Systems	W. Yuan et al.	2023	First to identify interaction-level privacy vulnerabilities in federated recommender systems; raises awareness about data security in distributed environments.
2	Agriculture Equipment's Rental System	Mr.ChetanNer, Mr. Vishal Hire, Ms.MansiSalunkhe, Ms.SayaliPatil, Mrs.BhawanaAhire	2023	Introduced a centralized digital platform connecting farmers and equipment owners; improved transparency, accessibility, and resource management through automation.
3	Representing Long-Range Context for Graph	Z. Wu et al.	2021	Enhanced graph neural networks using global attention mechanisms; improved

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	Neural Networks with Global Attention			model accuracy for complex, large-scale datasets.
4	FedGNN: Federated Graph Neural Network for Privacy-Preserving Recommendation	C. Wu et al.	2021	Combined federated learning with GNNs to ensure privacy-preserving recommendations; extended federated systems to networked data.
5	A Structure Constraint Matrix Factorization Framework for Human Behavior Segmentation	H. Gao et al.	2021	Proposed a novel segmentation framework with structure constraints; achieved high accuracy and robustness in behavior analysis.

III. PROPOSE SYSTEM OVERVIEW

The proposed system is a centralized, web-based platform designed to fix the problems of the current manual elective subject selection process in schools. It introduces role-based access control for four main users: Principal, Head of Department (HOD), Teacher, and Student. This setup ensures that everyone can perform tasks relevant to their role in an efficient and integrated way. The Principal module helps manage school-wide activities like department registration, HOD approvals, teacher assignments, and performance monitoring through an interactive dashboard. The HOD module supports departmental tasks such as approving elective subjects, allocating teachers, registering students, rescheduling exams, and generating reports. The Teacher module allows teachers to manage their profiles, approve student requests, upload study materials, schedule tests, and assess performance. The Student module provides secure registration and login, elective selection, teacher viewing, access to study materials, and performance tracking.

By putting these features together on one platform, the system promotes automation, transparency, and smooth coordination among all users. It cuts down on paperwork, reduces delays and human errors, and improves decision-making. Additionally, its scalable and modular design makes it suitable for expansion across multiple departments, ensuring it can fit institutions of different sizes while supporting long-term sustainability and better academic management.

A. Proposed System Modules

The proposed system is divided into four main modules: Principal Module, HOD Module, Teacher Module, and Student Module. Each one is designed to handle specific tasks effectively within a centralized digital framework. These modules ensure automated processes, clear communication, and smooth interaction among all parties involved in the elective subject selection process.

[1] Principal Module: The Principal module gives full control over operations at the institutional level. The Principal can register new departments, approve Head of Department (HOD) appointments, assign teachers to subjects, and monitor overall performance through a central dashboard. This module allows Principals to view reports, track academic activities, and ensure that departmental workflows run smoothly and transparently.

[2] HOD Module :The Head of Department (HOD) module handles departmental tasks related to elective subject administration. The HOD can approve elective subjects, assign teachers, manage student registrations, reschedule exams, and create academic performance reports. This module improves coordination between teachers and students, making sure departmental processes run smoothly and on time.

[3] Teachers Module :The Teacher module offers educators a specific platform to manage academic tasks online. Teachers can create and update their profiles, approve or reject student requests, upload study materials, schedule tests, record attendance, and assess student performance. This module lightens the manual workload, encourages timely communication, and helps keep accurate records of academic activities.

[4] Student Module:The Student module provides an interactive platform for students to manage their academic activities regarding electives. Students can securely register and log in, view the list of available elective subjects,

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choose their preferred courses, find their assigned teachers, download study materials, submit requests, and track their academic progress. This module improves transparency and helps students make informed academic decisions.

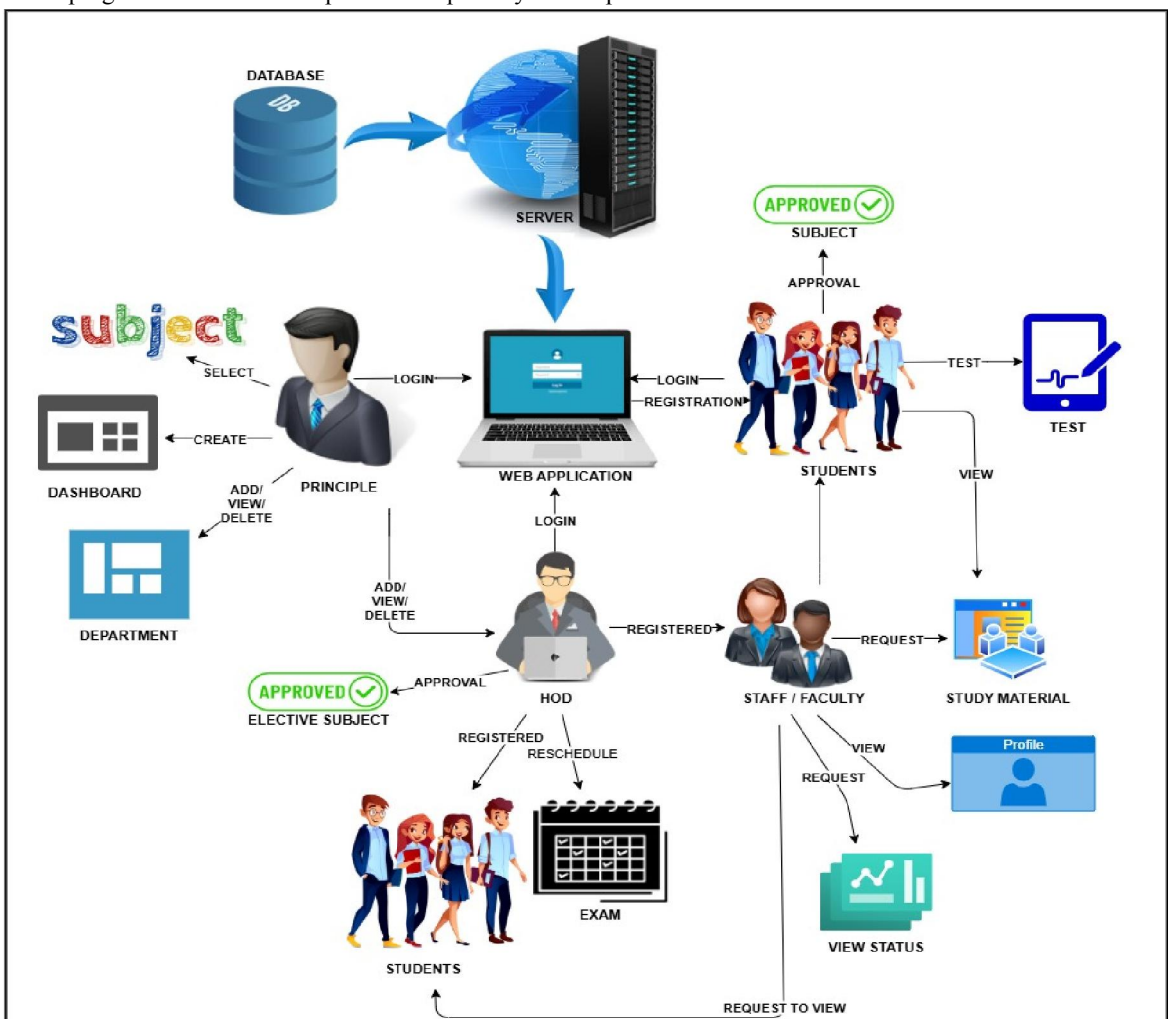

Fig. 1 Propose System Architecture

IV. EVALUATION AND ANALYSIS

The proposed Intelligent Elective Subject Selection System was evaluated to measure its effectiveness in improving academic process management. We compared its performance with the current manual process using several key parameters. These included efficiency, response time, accuracy, user satisfaction, and scalability. The evaluation aimed to find out how much the system improves transparency, reduces delays, and supports multi-user academic operations within an institution. thecolours used in each figure contrast well,

A. Evaluation parameters

- System Efficiency: The amount of time saved during elective registration, approval, and data handling compared to manual methods.
- Response Time:The latency between user requests and system responses under different load conditions.
- Accuracy: The precision with which the system processes elective selections, approvals, and allocations, minimizing human errors and duplication.

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- User Satisfaction: Measured through feedback surveys collected from students, teachers, HODs, and administrators based on usability, reliability, and overall user experience.
- Scalability:The ability of the system to maintain stable performance and responsiveness as the number of users or departments increases.

B. Analysis Result

A comparison was made between the current manual method and the suggested automated system. The results are shown in Table 1. It emphasizes important improvements in all performance areas.

Evaluation Metric	Manual System	Proposed System
Average Elective Selection Time	25–30 mins	5–8 mins
Error Rate in Allocation	12%	0–2%
Data Retrieval Time	15 sec	3 sec
Approval Process Time	2–3 days	1 hour
User Satisfaction (Survey)	65%	94%

Table No. 1

C. Analysis discussion

The analysis shows that the proposed system performs much better than the traditional manual process in all evaluation metrics. Automating elective selection, approval, and allocation greatly reduces human involvement. This leads to higher efficiency and consistency. The system can process student requests and teacher approvals in minutes, which is a big improvement over the long manual procedures.

The error rate fell from 12% in manual processing to less than 2% because of automated validation and centralized data management. Response time improved fivefold, which shows how effective the database-driven structure and optimized back-end processing are. Moreover, approval time went down from several days to just one hour. This reflects better coordination between departments through digital workflow automation.

Feedback from users—students, teachers, heads of departments, and administrators—showed a 94% satisfaction rate. This indicates strong acceptance and trust in the system's usability, reliability, and transparency. Also, performance testing with multiple users confirmed that the system stays stable and responsive. This validates its ability to scale and handle larger deployments in institutions.

D. Graphical Representation

The graphical analysis (Fig. 2) visually compares the manual and proposed systems in terms of time efficiency and accuracy, highlighting substantial performance gains achieved through automation and intelligent workflow integration.

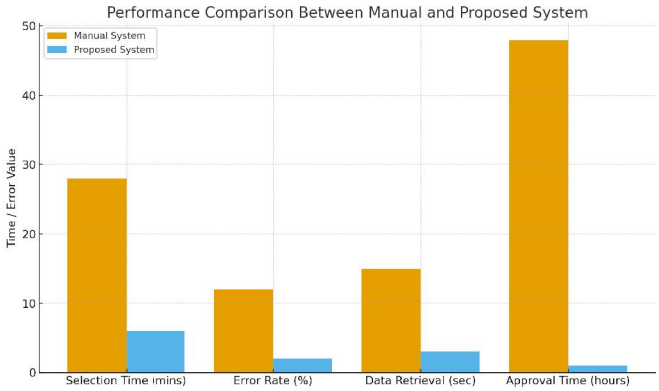

Fig. 2. Performance Comparison Between Manual And Proposed System

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D. Summary

Overall, the evaluation results show that the Centralized Digital Elective Subject Selection System is much better than the old manual method. It improves efficiency, accuracy, scalability, and user satisfaction, while also cutting down on processing time, workload, and human error. By incorporating real-time data access, automated approvals, and centralized management, the system offers a reliable, clear, and future-ready solution for managing academics in today's educational institutions.

V. CONCLUSIONS

The elective subject selection process is an important part of managing academics. It affects student growth, faculty workload, and how well the institution runs. However, the old manual system is slow, prone to mistakes, and lacks transparency. This leads to operational issues and communication problems between students, teachers, and administrators.

The proposed Centralized Digital Platform for Elective Subject Selection tackles these problems by automating subject selection, approval, scheduling, and performance tracking. With role-based modules for Principals, Heads of Departments (HODs), Teachers, and Students, the system boosts efficiency, accuracy, and accountability. It cuts down on paperwork, reduces delays, and improves transparency. This streamlines the workflows of the institution while enhancing the overall student learning experience. Additionally, the system's scalable and reliable structure makes it suitable for institutions of different sizes, offering a modern and sustainable solution for managing academics and embracing digital change in education.

VI. ACKNOWLEDGMENT

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