AI-Based Timetable Generation System aligned with NEP 2020 for Multidisciplinary Education Structures

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ABSTRACT-*Educational institutions face significant challenges in preparing class timetables that efficiently utilize faculty, classrooms, and academic resources while complying with the multidisciplinary framework introduced by the National Education Policy (NEP) 2020. Manual timetable preparation is time-consuming, error-prone, and difficult to modify whenever changes occur. This project presents an AI-Based Timetable Generation System aligned with NEP 2020 that automatically generates academic timetables through a user-friendly web application. The system allows users to select the department, semester, working days, subjects, period timings, and lunch break timing. Using intelligent scheduling logic, the application produces a structured timetable within seconds, reducing manual effort and improving scheduling efficiency. The project is developed using Flask, HTML, CSS, and JavaScript, providing a responsive interface for timetable generation.*

KEYWORDS: *Artificial Intelligence, Timetable Generation, NEP 2020, Flask, Scheduling System, Automation, Web Application.*

INTRODUCTION

Timetable generation is one of the most essential administrative tasks in educational institutions. Preparing a timetable manually requires balancing several constraints such as subjects, working days, period timings, faculty availability, and classroom utilization.

As institutions adopt the multidisciplinary approach recommended in NEP 2020, timetable preparation becomes increasingly complex. Artificial Intelligence provides intelligent techniques that simplify scheduling by automatically assigning

subjects to available periods while minimizing conflicts. The proposed AI-Based Timetable Generation System enables users to generate academic timetables quickly through a simple web interface. The system improves efficiency, reduces human errors, and supports flexible academic scheduling according to institutional requirements.

LITERATURE SURVEY

Several researchers have developed automated timetable generation systems using optimization algorithms, expert systems, and Artificial Intelligence techniques. Traditional scheduling methods often require significant manual intervention and are difficult to update whenever academic changes occur. With the implementation of NEP 2020, there is a growing demand for intelligent scheduling systems that can support multidisciplinary education structures while maintaining timetable quality.

RELATED WORK

Earlier timetable generation systems mainly depended on fixed scheduling rules or manual data entry. Many existing applications required administrators to prepare schedules separately before uploading them into institutional portals. Modern scheduling applications use optimization algorithms such as Genetic Algorithms, Constraint Satisfaction Problems, and Artificial Intelligence to improve timetable generation.

However, many available systems are expensive, complex to configure, and unsuitable for small educational institutions.

EXISTING SYSTEM

The existing timetable preparation process is mostly performed manually using spreadsheets or documents. This approach consumes considerable time and often results in scheduling conflicts, duplicated subjects, and inefficient utilization of academic resources. Most existing systems do not support customizable working days, editable lunch break timings, or quick timetable regeneration after modifications. They also require significant human effort whenever institutional policies change.

PROPOSED SYSTEM

The proposed AI-Based Timetable Generation System automatically generates academic timetables through a web-based interface.

The user enters department details, semester, working days, subjects, period timings, and lunch break timing. The scheduling module processes these inputs and allocates subjects intelligently across available periods. The generated timetable is displayed instantly in a structured tabular format. The system provides flexibility by allowing users to modify scheduling parameters without changing the application code. It significantly reduces manual work and improves scheduling accuracy while supporting NEP 2020 multidisciplinary education structures.

SYSTEM ARCHITECTURE

The system architecture consists of a Login Module, Flask Server, Timetable Generation Module, User Input Interface, Scheduling Logic, and Output Display Module. Initially, the user logs into the application.

The Flask server processes the request and loads the timetable generation interface. Users provide scheduling information including department, semester, working days, subjects, period timings, and lunch break details. The scheduling module processes these inputs and automatically generates the timetable, which is displayed through the web interface.

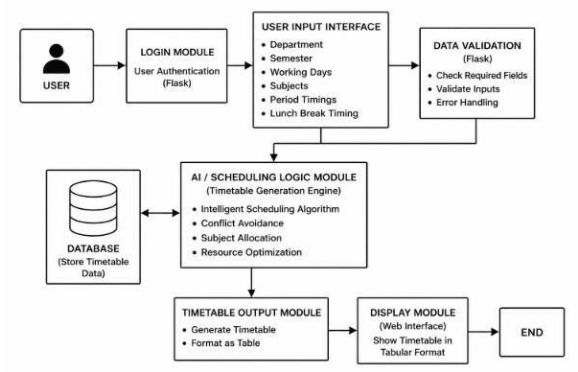

Fig 1: System Architecture

METHODLOGY DESCRIPTION

The proposed AI-Based Timetable Generation System follows a simple and systematic methodology to automate timetable creation. Initially, the user logs into the application and enters the required details such as department, semester, working days, subjects, period timings, and lunch break timing through a user-friendly interface. The Flask-based backend receives and validates the input data before passing it to the timetable generation module. The scheduling logic then intelligently allocates subjects across the available periods while maintaining the specified working days and lunch break. Finally, the generated timetable is displayed in a structured tabular format on the web page, allowing users to view and modify the schedule easily. This methodology minimizes manual effort, reduces scheduling errors, and provides an efficient solution for generating academic

timetables aligned with the multidisciplinary framework of NEP 2020.

RESULTS AND DISCUSSION

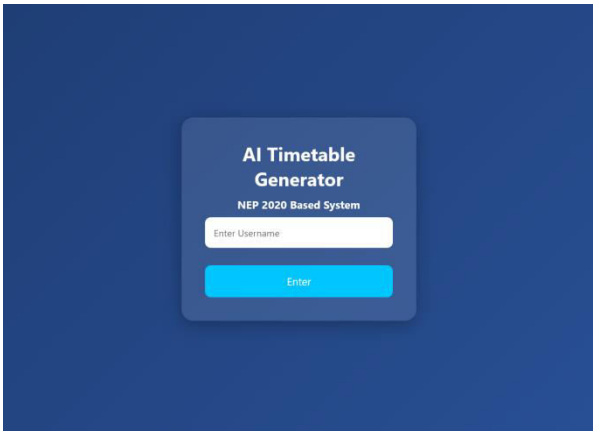

Fig2: Login Page

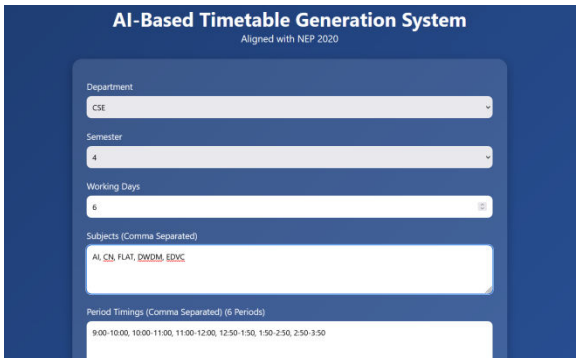

Fig 3: Dashboard

The developed system successfully generates academic timetables based on user inputs. Users can customize department, semester, working days, subjects, period timings, and lunch break timing according to institutional requirements.

The generated timetable is displayed in a clear tabular format, improving readability and reducing scheduling errors. The application demonstrates that automated timetable generation significantly decreases the time required for timetable preparation compared to manual scheduling methods

Fig4: Time-Table Generation

The generated timetable is displayed in a clear tabular format, making it easy for faculty members and administrators to understand and use. This flexibility makes the system suitable for different departments and academic schedules. The responsive interface and efficient scheduling logic demonstrate that the application can effectively support educational institutions implementing the multidisciplinary education framework of NEP 2020.

CONCLUSION

The AI-Based Timetable Generation System aligned with NEP 2020 provides an efficient solution for academic timetable preparation. The system automates scheduling, minimizes manual effort, and generates structured

timetables based on user requirements. The developed application is simple, reliable, and suitable for schools, colleges, and universities implementing multidisciplinary education structures.

FUTURE SCOPE

The proposed system can be enhanced by integrating advanced Artificial Intelligence and Machine Learning algorithms for conflict-free scheduling based on faculty availability, classroom allocation, laboratory sessions, and elective courses. Future versions may include automatic faculty assignment, classroom management, cloud database integration, PDF and Excel export, timetable editing, student portals, and Generative AI support using Google Gemini API to generate optimized timetables dynamically based on institutional constraints.

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