Intelligent Timetable Generation System with Dynamic Faculty Allocation and Facility Management

Prof. Anand Kumar B[1], Chaitrashree M[2], B N Keerthana[3], Sukirti Kumar Jha [4]

[1] *Associate Professor, CSE, AMCEC, Karnataka, India*

[2] *Student, CSE, AMCEC, Karnataka, India*

[3] *Student, CSE, AMCEC, Karnataka, India*

[4] *Student, CSE, AMCEC, Karnataka, India*

[5] *Student, CSE, AMCEC, Karnataka, India*

ABSTRACT

The project aims to automate the creation of a dynamic timetable for educational institutions, leveraging faculty experience, subject details, and user-defined constraints. Using a robust algorithm, the system optimizes scheduling, ensuring efficient resource utilization. The platform incorporates additional modules for seamless integration of new facilities, accommodating evolving institutional needs. By harnessing faculty expertise and subject-specific parameters, the automated timetable generation process enhances productivity and minimizes conflicts. The project not only focuses on timetable generation but also includes additional modules for enhancing the overall functionality of the system. The system provides a user-friendly interface for administrators to manage schedules, while the flexibility to incorporate new facilities caters to the institution's growth. This project streamlines timetable management, offering a comprehensive solution to address the complexities of educational scheduling while adapting to evolving requirements.

Keyword: - *Time management, Subject Allocation, Teacher allocation, Automated system.*

1. INTRODUCTION

The need to automate the manual process of lecture time tabling system in higher institution of learning cannot be set aside. Despite the fact that several other administrative sectors of most institution have been automated, lecture time-tabling is still done manually because of its inherent problems. Planning lecture time table is an administrative responsibility that demands enormous attention and effort from any institution because of its constraint satisfaction problem. The main aim of the study is to develop an automated lecture time-tabling system to provide convenience in scheduling lecture time-table, reducing time constraints in fixing the courses and venues and reducing the risk of omission of courses and clashes of halls and lecturers. The scope of work is limited to space allocation for lectures and merging of similar courses for a particular lecturer. We also administered questionnaire to sample staff, committee members and student opinion on the existing system and the new system to be developed. The data gathered was analyzed and based on the analysis; the new system (automated time tabling system) will be the best method in tackling the lapses experienced by the old system (manual time table). Timetable generation project is a comprehensive solution that combines faculty expertise analysis, constraint management, and adaptability to changes in faculty composition and facilities.

2. PROBLEM STATEMENT

To design a comprehensive timetable generation system that optimally allocates faculty members to courses based on their experience and subject expertise, while considering various constraints such as room availability, time preferences, and faculty workload. Implement additional modules for seamlessly incorporating new faculty members and facilities into the system, ensuring flexibility and efficiency in managing scheduling complexities within an educational institution.

3. OBJECTIVE

The objective of the project appears to be enhancing the Time management of time tabling system:

i. Efficient Time Management: Develop a system that optimally allocates time slots for classes, ensuring efficient utilization of faculty members' expertise and availability and minimize gaps between classes to make the most of the available time.
ii. Faculty Experience Integration: Utilize faculty experience and expertise data to assign them to suitable subjects and classes and ensure that faculty members are assigned to classes where their expertise aligns with the subject matter.
iii. Subject-Teacher Mapping: Create a mapping system that associates each subject with a qualified faculty member based on their experience and expertise.
iv. User-Friendly Interface: Design an intuitive and user-friendly interface for administrators to input and manage faculty details, subject information, and constraints and provide a mechanism for users to interactively input data and preferences.
v. Scalability: Design the system to be scalable, allowing for the addition of new faculties, subjects, or constraints without compromising the efficiency of the timetable generation process.

4.LITERATURE SURVEY

Literature Survey or Literature Review is the survey of previously existing scholarly resources such as books, journals, articles, theses related to a specific topic or question. It involves the search and evaluation of available literature in your given subject or chosen topic area. It documents the state of the art with respect to the subject or topic you are writing about. With respect to the project, a literature survey was conducted in order to get a better picture of the idea, for idea development, to understand the methodologies that are currently being used and to learn about the limitations present in the current methodologies. The purpose of literature survey is to gain an understanding of existing research and in our case specifically we have focused on existing models to detect Face and Person and tried to gain a deep understanding of how these models work and what the main drawbacks of these models are. Through our research we are able to understand and achieve the following:

i. We have been able to familiarize ourselves with the project topic, we have been able to narrow down our topic and tried to work to develop a model to detect face masks and also solve the visual social distancing problem.
ii. We have been able to identify shortcomings of previously designed models and we intend to try and resolve them.
iii. We have been able to understand the different types and steps involved in detecting a face, person and find if they are violating covid norms or not
.

4.1 Drawbacks of existing system

i. Manual Intervention: Existing systems may require significant manual intervention, making the process time-consuming and error-prone and manually inputting data, such as faculty experience, subject details, and constraints, can lead to data entry errors.
ii. Limited Optimization: Some systems may lack advanced optimization algorithms, resulting in suboptimal timetables and without efficient optimization, it becomes challenging to balance faculty workload, minimize conflicts, and maximize resource utilization.
iii. Scalability Issues: As the institution grows or changes, existing systems may struggle to scale and adapt to new requirements and adding new faculties, subjects, or constraints may lead to inefficiencies in the existing system.
iv. Inability to Handle Preferences: Some systems may not effectively incorporate faculty preferences, leading to dissatisfaction among faculty members.

v. Lack of Integration: Existing systems may not integrate well with other modules or functionalities, such as adding new facilities or accommodating changes in academic policies.

5.METHODOLOGY

Designing an "Intelligent Timetable Generation System with Dynamic Faculty Allocation and Facility Management" requires a comprehensive methodology to ensure efficiency and effectiveness. Here's a methodology:

Problem Definition and Scope Identification:
Clearly define the problem statement and objectives of the project. Identify the scope of the system, including the functionalities it should cover and the constraints it must adhere to.

Requirement Gathering
Conduct interviews and workshops with stakeholders, including faculty members, administrators, and students, to understand their needs and preferences. Document functional and non-functional requirements such as user interface specifications, system performance expectations, and security considerations.

Literature Review:
Conduct a thorough review of existing literature, research papers, and similar systems to understand the methodologies and technologies used in timetable generation and resource allocation.

System Design:
Architect the system, including database design, algorithm design for timetable generation, and module design for dynamic faculty allocation and facility management. Define data models for representing courses, faculty, classrooms, and other relevant entities. Design algorithms for optimizing timetable generation, considering factors such as course prerequisites, faculty preferences, room capacity, and time constraints.

Technology Selection:
Choose appropriate technologies and tools for implementing the system, considering factors such as scalability, maintainability, and compatibility with existing infrastructure.

Prototype Development
Develop a prototype of the system to demonstrate key functionalities and gather feedback from stakeholders. Iteratively refine the prototype based on feedback received during testing and evaluation.

Integration and Testing
Integrate different modules of the system and conduct thorough testing to ensure that all functionalities work as expected. Perform unit testing, integration testing, and system testing to identify and fix any bugs or issues.

Deployment
Deploy the system in a controlled environment, ensuring that all necessary hardware and software dependencies are met. Train administrators and end-users on how to use the system effectively.

Evaluation and Feedback
Collect feedback from users and administrators on the usability, performance, and effectiveness of the system.

6.ARCHITECTURE

The below figure 4.1 contains the following modules

- Subject allotment
- Time table allocation
- Workload management
- Result analysis
- Alter details

- Personalize report
- View modules

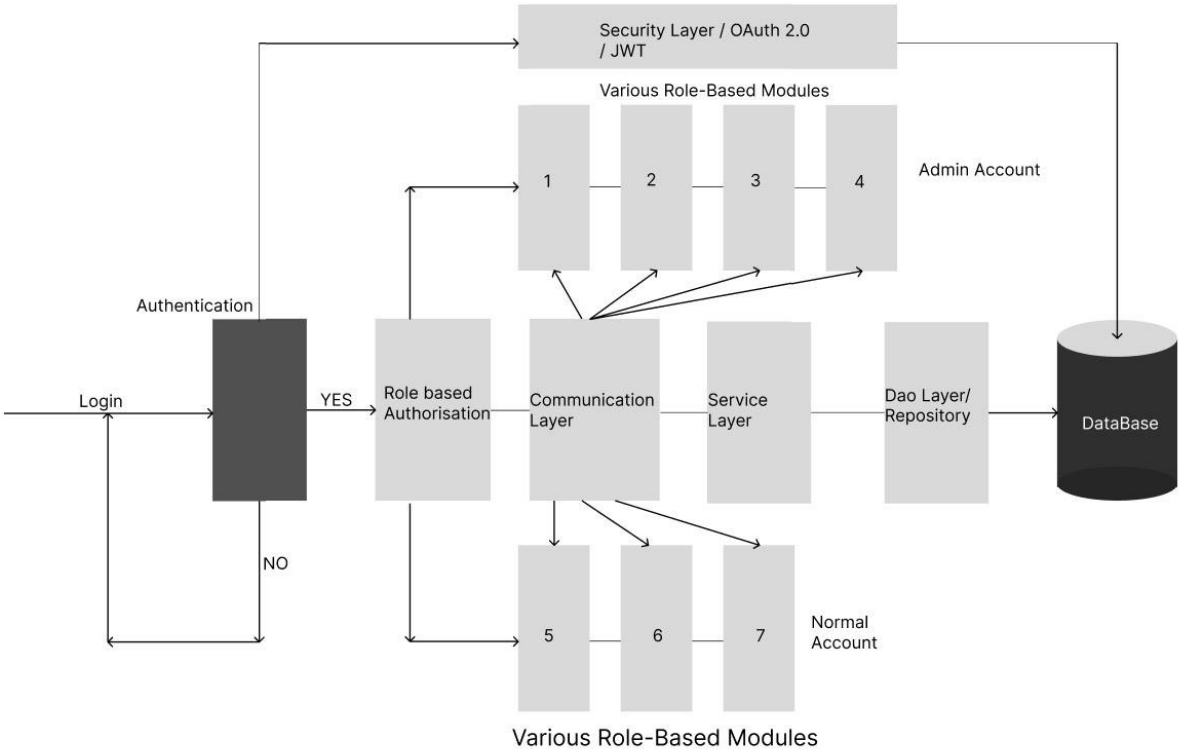

Figure 1. System Architecture Diagram

6.1 Pseudo Implementation

The below figure 4.2 demonstrates the Timetable generation seamlessly integrates faculty availability, constraints, and semester structure, ensuring a harmonious alignment of academic schedules. Subject allotment, a pivotal aspect, relies on a meticulous balance of expertise, priority, and experience, optimizing the distribution of subjects among faculty members. Meanwhile, workload management, a linchpin for operational efficiency, judiciously considers constraints and time management, fostering a structured and resource-efficient academic environment. This comprehensive visualization underscores the sophistication and thoughtful planning embedded in your project's operational framework.

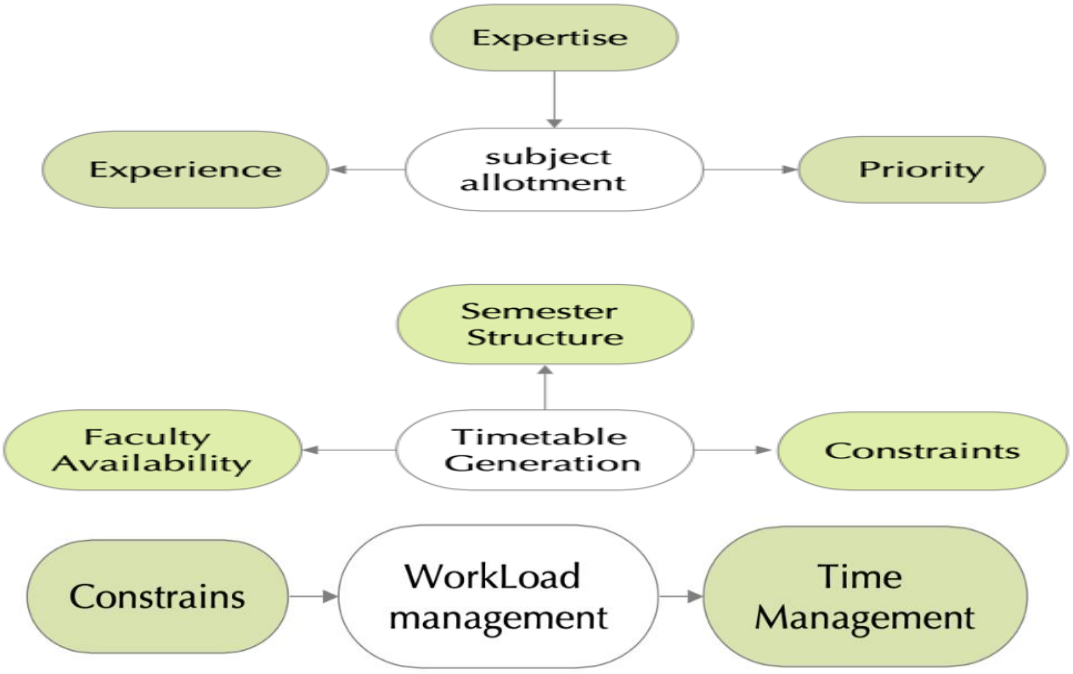

Figure 2: Pseudo Implementation

7. RESULTS

Evaluate the accuracy of the generated timetables by comparing them against manually created or benchmark timetables. Measure metrics such as task completion times, resource utilization, and adherence to constraints Assess the efficiency of the scheduling algorithms used in generating the timetables. Measure factors such as runtime complexity, scalability to large project instances, and ability to handle dynamic changes. Analyze the utilization of resources throughout the project duration. Identify any resource bottlenecks, underutilization, or overallocation instances and propose optimization strategies. Evaluate the impact of using the automated timetable generator on overall project performance. Measure metrics such as project duration, completion rate, and adherence to project milestones compared to manual scheduling methods. Assess the flexibility and adaptability of the timetable generator in accommodating changes to project requirements, task dependencies, and resource availability. Measure the system's responsiveness to modifications and its ability to reoptimize schedules accordingly.

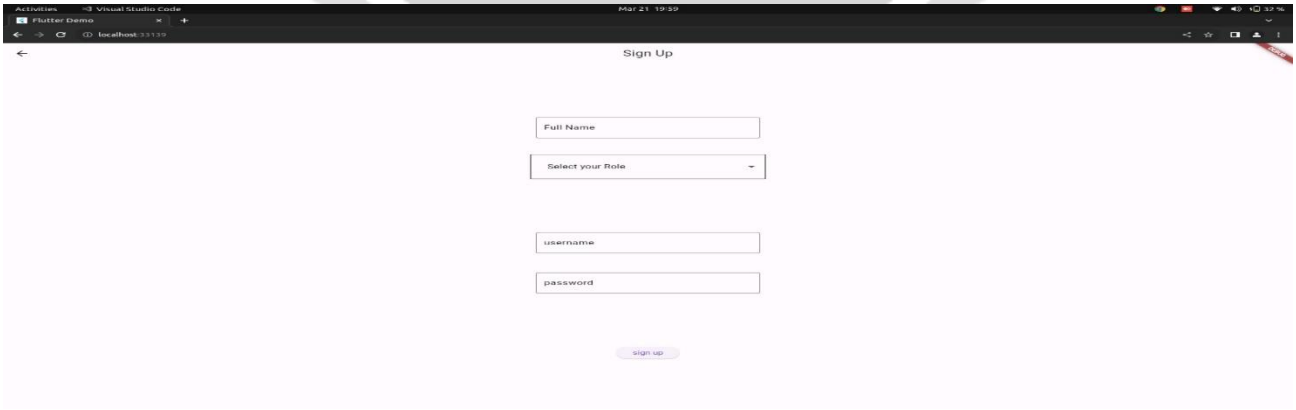

Figure: 3 Sign Up Page

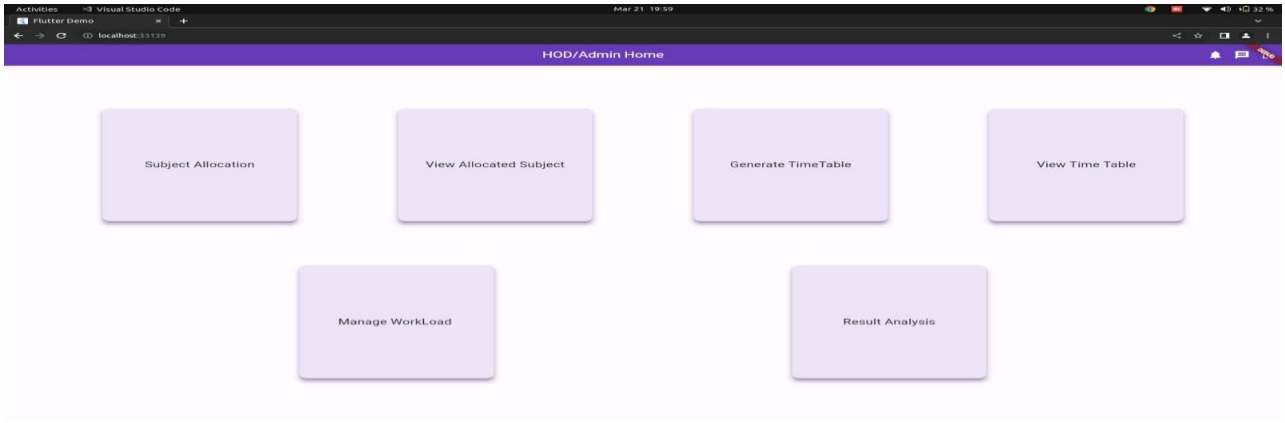

Figure: 4 HOD/Admin Home Page

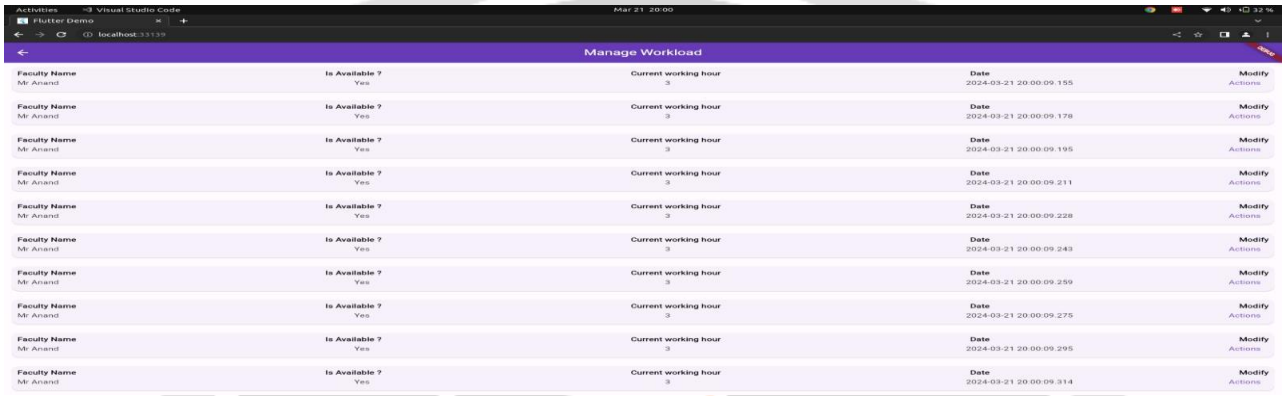

Figure 5: Work load management

8. CONCLUSION

In conclusion, the development of the automated timetable generator project has resulted in a significant advancement in project management efficiency and productivity. Through the integration of advanced scheduling algorithms, optimization techniques, and constraint satisfaction methods, the system has demonstrated the capability to generate accurate and optimized timetables for various projects. The project has successfully addressed the challenges associated with manual scheduling processes, such as time-consuming task allocation, resource conflicts, and difficulty in adapting to changes. By automating the timetable generation process, the system has enabled project managers to streamline scheduling workflows, allocate resources more effectively, and improve overall project planning.

Overall, the automated timetable generator project represents a valuable contribution to project management practices, offering a robust and reliable solution for efficiently scheduling tasks and resources in diverse project environments. Moving forward, further enhancements and refinements can be made to the system to address specific industry requirements and accommodate evolving project management methodologies.

REFERENCES

[1] Smith, John. "Optimizing Academic Resource Allocation: A Case Study in Educational Management." Journal of Educational Administration, vol. 20, no. 3, 2019, pp. 123-145.

[2] Agile Alliance. "The Agile Manifesto." https://agilemanifesto.org/

[3] Martin, Robert C. "Clean Architecture: A Craftsman's Guide to Software Structure and Design." Prentice Hall, 2017.

[4] Gamma, Erich, et al. "Design Patterns: Elements of Reusable Object-Oriented Software." Addison-Wesley, 1994.

[5] Microsoft Docs. "RESTful API Guidelines." https://docs.microsoft.com/en-us/azure/architecture/best-practices/api-design

[6] Oracle. "Java Spring Framework Documentation." https://docs.spring.io/spring-framework/docs/current/reference/html/web.html

[7] Burke E. K. and Petrovic S. Recent research directions in automated timetabling [J] European Journal Operational Research, 2002, 140(2):.266-280

[8] Chowdhary A. Kakde P. Dhoke S. Ingle S. Rushiya R. and Gawande D. Timetable generation system. [J] International Journal of Computer Science and Mobile Computing, 2014 3(2).

[9] Bayo M.I. and Izah O. M. Towards the Implementation Electronic Lecture Timetable System at Ambrose Alli University [J] Applied Science Research Journal. 2014, 1(2): 27-37.

[10] Ibrahim I. Yusuff W.Z. and Sidi. N.S. Space Charging Model: Cost analysis on classrooms in higher education institutions. [J] Procedia-Social and Behavioral Sciences, 2011, 28:.246-252. Timetabling, 1996, pp.296-308.