

# Automated Time Table Scheduling System Using Genetic Algorithm

Vaishnavi Badhe<sup>1</sup>, Aryan Chikte<sup>2</sup>, Aditya Gadhe<sup>3</sup>, Mrudula Ghongade<sup>4</sup>

<sup>1</sup>BE Final Year, Department of Computer Engineering, Zeal College of Engineering & Research, Narhe, Pune, Maharashtra, India – 411041

<sup>2</sup>BE Final Year, Department of Computer Engineering, Zeal College of Engineering & Research, Narhe, Pune, Maharashtra, India – 411041

<sup>3</sup>BE Final Year, Department of Computer Engineering, Zeal College of Engineering & Research, Narhe, Pune, Maharashtra, India – 411041

<sup>4</sup>BE Final Year, Department of Computer Engineering, Zeal College of Engineering & Research, Narhe, Pune, Maharashtra, India – 411041

\*\*\*

**Abstract** - Academic timetable preparation is a repetitive and time-consuming task in educational institutions. Manual timetable creation often results in scheduling conflicts, uneven faculty workload distribution, and significant administrative effort. This paper presents an Automated Time Table Scheduling System that generates optimized timetables using a Genetic Algorithm approach. The proposed system accepts information related to faculty members, subjects, batches, and lecture requirements as input and produces a conflict-free timetable while satisfying predefined constraints. Hard constraints such as preventing overlapping lectures for teachers and student groups are strictly enforced, whereas soft constraints such as balanced faculty workload are optimized. The system reduces scheduling effort, improves accuracy, and provides an efficient alternative to traditional manual timetable preparation. Experimental observations indicate that the proposed solution generates feasible timetables within a short time while maintaining scheduling quality.

**Key Words:** Timetable Scheduling, Genetic Algorithm, Optimization, Automation, Educational Management System, Scheduling Constraints.

## 1. INTRODUCTION

Timetable scheduling is one of the most important administrative activities in schools, colleges, and universities. The process involves assigning subjects, faculty members, and student batches to available time slots while satisfying various institutional constraints. Traditionally, timetable preparation is performed manually, which requires significant time and effort. As

the number of departments, teachers, and subjects increases, the complexity of scheduling also increases.

The timetable scheduling problem belongs to the category of NP-hard optimization problems. Multiple valid schedules may exist, but only a few satisfy all constraints effectively. Therefore, intelligent optimization techniques are required to generate practical solutions.

The proposed Automated Time Table Scheduling System utilizes a Genetic Algorithm to automate timetable generation. Genetic Algorithms imitate the process of natural selection and evolutionary optimization. By evaluating multiple timetable combinations and selecting the most suitable solution, the system produces an optimized schedule with minimal conflicts.

## 2. Literature Survey

Several approaches have been proposed for solving timetable scheduling problems. Traditional methods rely on manual preparation or rule-based systems, which become inefficient as scheduling complexity increases. Researchers have explored optimization techniques such as Genetic Algorithms, Simulated Annealing, Particle Swarm Optimization, and Constraint Satisfaction Methods.

Among these techniques, Genetic Algorithms have demonstrated strong performance in handling complex scheduling constraints. They allow exploration of a large search space while continuously improving solution quality through selection, crossover, and mutation operations. Due to their flexibility and adaptability,

Genetic Algorithms are widely adopted for educational scheduling applications.

| Author(s)       | Year | Focus Area           | Research Gap          |
|-----------------|------|----------------------|-----------------------|
| Burke et al.    | 2021 | Timetabling          | Scalability issues    |
| Lewis           | 2022 | Scheduling           | High execution time   |
| Abdullah et al. | 2023 | Constraint Solving   | Limited flexibility   |
| Colomi et al.   | 2024 | Genetic Algorithm    | Parameter dependency  |
| Proposed System | 2026 | Automated Scheduling | Improved optimization |

### 3. PROPOSED SYSTEM

The proposed system automates timetable generation by processing academic scheduling requirements and producing an optimized timetable.

#### 3.1 System Inputs

The system accepts the following information:

- Faculty details
- Subject information
- Student batches
- Weekly lecture requirements
- Available time slots

#### 3.2 Hard Constraints

The following constraints must always be satisfied:

- A faculty member cannot conduct two lectures simultaneously.
- A student batch cannot attend multiple lectures at the same time.
- Lecture assignments must remain within available scheduling slots.

#### 3.3 Soft Constraints

The following constraints are optimized whenever possible:

- Balanced distribution of workload among faculty members.
- Allocation of required teaching hours to each batch.
- Improved timetable arrangement for efficient utilization.

#### 3.4 Genetic Algorithm Workflow

Step 1: Generate an initial population of random timetable solutions.

Step 2: Evaluate each timetable using a fitness function.

Step 3: Select high-fitness timetables.

Step 4: Perform crossover and mutation operations.

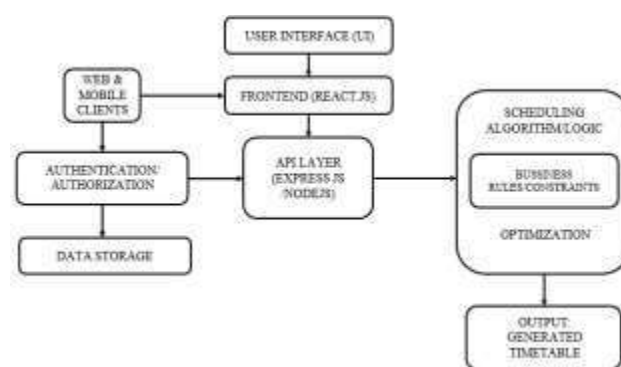
Step 5: Generate a new population.

Step 6: Repeat the process until an optimal timetable is obtained.

The fitness function measures the quality of a timetable by checking constraint violations and rewarding feasible schedules.

At the first occurrence of an acronym, spell it out followed by the acronym in parentheses, e.g., charge-coupled diode (CCD).

### 4. PROPOSED SYSTEM ARCHITECTURE



### 5. CONCLUSIONS

This paper presented an Automated Time Table Scheduling System based on Genetic Algorithm optimization. The proposed approach efficiently handles timetable generation by satisfying hard constraints and optimizing soft constraints. The system reduces manual effort, improves scheduling accuracy, and generates feasible timetables within a short duration. The implementation demonstrates that Genetic Algorithms provide an effective solution for academic scheduling problems.

Future enhancements may include classroom allocation, attendance integration, cloud deployment, and advanced optimization techniques for larger institutions.

## 6. ACKNOWLEDGEMENT

The authors express sincere gratitude to the project guide, faculty members, and institution for their valuable guidance and support during the development of this project.

## 7. REFERENCES

- [1] Z. Michalewicz, Genetic Algorithms + Data Structures = Evolution Programs, Springer.
- [2] D. E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison-Wesley.
- [3] E. Burke and J. Petrovic, "Recent Research Directions in Automated Timetabling," European Journal of Operational Research.
- [4] S. Abdullah et al., "A Review of Educational Timetabling Problems," International Journal of Computer Science.
- [5] R. Lewis, A Survey of Metaheuristic-Based Techniques for University Timetabling Problems.
- [6] J. Holland, Adaptation in Natural and Artificial Systems.
- [7] A. Colomi, M. Dorigo, and V. Maniezzo, "Genetic Algorithms for Timetable Optimization."
- [8] T. Blickle and L. Thiele, "A Comparison of Selection Schemes Used in Genetic Algorithms."