Vivekananda College of Engineering & Technology

[A Unit of Vivekananda Vidyavardhaka Sangha Puttur®]

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DEPARTMENT OF CSE (DATA SCIENCE)

Project Phase I Presentation on

Web-Based Automatic Timetable Scheduler for Schools & Colleges

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➢ Problem Statement

- Timetable scheduling is an NP-Hard combinatorial optimization problem faced by educational institutions. The challenge involves allocating courses, instructors, students, and classrooms to specific time slots while adhering to multiple constraints.
- The traditional manual approach to timetable generation is time-consuming, and increases complexity.

➢ Existing solution

- Timetables are manually created by coordinators, requiring significant time and effort to ensure proper scheduling. Coordinators must carefully analyse multiple factors to prevent conflicts such as overlapping lectures, faculty unavailability and limited classroom resources, making the process prone to errors.
- The automation techniques do not prove efficient as they are not able to satisfy the constraints where the same faculty member is allotted with continuous classes

➢ Proposed Solution

The proposed solution utilizes a Genetic Algorithm (GA) for automatic timetable generation. GA mimics natural selection principles to evolve an optimal timetable by iteratively improving solution. This method ensures:

- Minimized timetable conflicts.
- Optimal utilization of resources (classrooms, faculty, and time slots).
- Reduction in human intervention and errors.

➢ Technology Used

- **Programming language**: Python, Django framework

  Python offers extensive libraries that support data processing, optimization, and user interface creation.

  Python frameworks like Django are utilized for backend development, enabling secure database management and seamless interaction between different system components.

- **Algorithm**: Genetic Algorithms

  Genetic algorithms (GAs) are frequently applied to timetabling problems, which are known to be NP-hard optimization problems, because GAs are effective for finding optimal or near-optimal feasible solutions among a complex set of variables and constraints.

➢ Requirements

System Requirements:

- PC should have at least 4 GB of RAM,
- Windows 7 and upwards.
- Python version least 3.8 or above.
- SQLite default database.
- Internet access.

Project Components:

- Identifying the requirements of the institution.
- Details about the Faculty, Courses, Classes, Classrooms, Labs.
- Customization of timetable as per the requirements.

➢ Literature Review

- Timetable scheduling is an NP-hard problem, as it involves a high level of computational complexity, and finding an exact solution is often infeasible within a reasonable time for large instances.
- Genetic Algorithms have gained popularity due to their effectiveness in solving NP-hard optimization problems like timetabling.
- As a result, extensive research has been conducted on applying optimization techniques to address this challenge.
- This literature review explores various existing approaches to automated timetable generation, with a particular focus on Genetic Algorithms.

➢ Literature Review

Title	Author	Methodology	Advantages	Future Work/ Limitations
A utilization-based genetic algorithm for solving the university timetabling problem (uga).	Esraa A. Abdelhalim, Ghada A. El Khayat	Utilization-based genetic algorithm: focused on optimizing space utilization alongside satisfying scheduling constraints.	Improved space utilization, reduced hours, real data is being used.	lacks real-time adaptability.
A genetic algorithm to solve the timetable problem.	Alberto Colorni, Marco Dorigo, Vittorio Maniezzo	Genetic Algorithm with customized genetic operators like row-based crossover, order-k mutation, and a filter.	Reduced time vs. manual & simulated annealing.	Scalability issues, no dynamic adjustment can be made. Lacks faculty preferences.

➢ Literature Review

Title	Author	Methodology	Advantages	Future Work/ Limitations
A novel genetic algorithm technique for solving university course timetabling problems.	Othman M. K. Alsmadi, S. Za'er, Dia I. Abu-Al-Nadi, Alia Algsoon	Genetic algorithm which involves rank based selection, with a generation limit of the fitness ≥ 0.99.	Zero hard constraint violations, reduced overload.	No real-time adaptability, lacks sensitivity to constraint weights
Gradual Optimization of University Course Scheduling Problem Using Genetic Algorithm and Dynamic Programming.	Xu Han, Dian Wang	Hybrid approach which is a combination of Dynamic Programming and Genetic algorithm.	Improved quality, reduced room use and outperformed PSO, ACO, PSM.	No cross-institution testing, lacks integration into university systems.

➢ Literature Review

Title	Author	Methodology	Advantages	Future Work/ Limitations
Student timetabling genetic algorithm accounting for student preferences.	Ahmed Redha Mahlous, Houssam Mahlous	GA with binary chromosome, simulated annealing based function and adaptive mutation.	Solves student preference satisfaction with adaptive mutation	No user interface, not deployed in real-time, fixed schedules only
Smart Timetable Generation using Genetic Algorithm.	Sahith Siddharth Paramatmuni, Dumpala Yashwanth Reddy, Elakurthi Sai Spoorthi, Akhil Dharani, K. Venkatesh Sharma	Web-based GA with roulette/tournament selection, weighted fitness function; implemented in Django; outputs Excel files.	Fast scalable and provides conflict resolution.	Manual weight tuning, limited collaborative input, reduced performance under extreme constraints

➢ Literature Review

Title	Author	Methodology	Advantages	Future Work/ Limitations
Institute Timetable Scheduler.	Bhaven Gore, Disha Shirdhankar, Giriraj Belanekar	GA encoding course, instructor, room and GUI for input, fitness function penalizes clashes/overloads, output in Excel.	GUI interface, conflict-free timetables, Excel sheet export	No soft constraints, Lacks scalability.
Genetic algorithm for solving university course timetabling problem using dynamic chromosomes.	Ghazi Alnowaini, Amjad Abdullah Aljomai	Genetic Algorithm using dynamic chromosomes for course-time-room tuples, roulette wheel selection; two-point crossover, optimized mutation.	93% conflict-free, handles varying loads.	Poor performance beyond 82 courses, lacks real-time and automation

➢ Conclusion

- The intention of the algorithm to generate a time-table schedule automatically is satisfied. The algorithm incorporates a number of techniques, aimed to improve the efficiency of the search operation. By automating this process with the help of computer assistance timetable generator can save a lot of precious time of administrators who are involved in creating and managing various timetables of the institute.
- This reduces time consumption and the error in framing the timetable manually. The benefits of this approach are simplified design and reduced development time.

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