# DESIGN AND IMPLEMENTATION OF AN AUTOMATIC EXAMINATION TIMETABLE GENERATION AND INVIGILATION SCHEDULING SYSTEM

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**Abstract:** The hand operated system of time table preparation in colleges is very monotonous and time-consuming which results in either the same teachers ending up with more than one class at a time or a number of classes conflicting at the same classroom. Due to a non-automatic perspective, absolute utilization of resources has proven ineffective. The difficulties that arise during the generation of timetables are definite and are concerned mainly with assigning events to timeslots subject to constraints with the resultant solution constituting a timetable. In this study we use a genetic algorithm to get an optimal timetable. The system will take different inputs like number of subjects, teachers, maximum lectures a teacher can conduct, priority of subject and topics to be covered in a week or a lecture, considering which, it will create feasible time tables for working days of the week, making excellent application of all resources in a way which will be best suited for the constraints. The genetic algorithm considers metrics such as-Fitness function, Room utilization, Teacher workload balance, Minimization of constraint violations, Adaptability to changes. A suitable timetable is then chosen from the optimal solutions generated. The result includes individual timetable for each teacher.

***Keywords -*** Genetic algorithm, Monotonous and Time-Consuming, Feasible Timetables, Optimal Solutions

## I INTRODUCTION

Timetabling in universities can be a complex task, and various challenges may arise during the process. Some common problems with timetables in universities include:

Limited availability of classrooms, labs, and other facilities can lead to difficulties in scheduling classes, especially during peak hours. Coordinating the availability of faculty members for specific courses and time slots can be challenging, especially when dealing with part-time or adjunct instructors. Efficiently utilizing available space and avoiding underutilization or overcrowding in classrooms is an ongoing challenge.• Utilize available resources, such as classrooms, faculty, and time slots, in an optimal manner to minimize conflicts and ensure efficient use. Reduce the time and effort required for timetable creation by automating the process, allowing for quicker adaptation to changes and updates. Ensuring that there are no overlapping schedules for courses required by the same students or faculty members can be a significant challenge.

The need for constant adjustments due to changes in faculty availability, room availability, or unforeseen events can disrupt the initial schedule. In genetic algorithms, the following steps are typically used: Initialization: Generate an initial population of individuals (possible solutions) randomly or using some heuristic method. Selection: Select individuals from the population based on their fitness (ability to solve the problem). Individuals with higher fitness are more likely to be selected. Crossover/Recombination: Create new individuals by combining genetic material from two selected individuals (parents). This is usually done by selecting a crossover point and swapping genetic information between parents. Mutation: Occasionally, randomly change some genetic information in new individuals to introduce diversity into the population. Evaluation: Evaluate the fitness of new individuals. This step determines how well the new individuals solve the problem. Replacement: Select individuals from the current population and the new population to form the next generation. This can be done using various strategies, such as elitism (keeping the best individuals) or tournament selection. Termination Criteria: Determine when to stop the algorithm. This can be based on the number of generations, the fitness of the best individual, or a predefined threshold. Repeat: Repeat the selection, crossover, mutation, evaluation, and replacement steps for a certain number of generations or until the termination criteria are met**.**

## II LITERATURE SURVEY

University timetable scheduling is a combinatorial problem where finding the best solution is hard when the search space goes big. Knowing the background of the problem helps understand why even at computing era, solving it is a somewhat monumental task. Getting to know the possible solutions for the problem is also needed as it might show some of the shared traits that might lead to a breakthrough in finding a better solution. Finally, gathering information regarding the proposed solution will help guide the research into forming better solution

***"Design and implementation of an automatic examination timetable generation and invigilation scheduling system using a genetic algorithm-2019"***

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Timetable scheduling is the process of creating timetables that fit the constraints of the scenario. It is used in a magnitude of the industry from scheduling transportation to creating complex schedules for highly-optimized automated factories. The majority of small-scale scheduling is done manually while larger operations require computer-assisted scheduling. A genetic algorithm is a met heuristic that mimics the process of natural selection. It can be performed in multiple different ways with different types but it will all follow the same concept. This research aims to create artificial intelligence through the use of an evolutionary algorithm, specifically a genetic algorithm combined with adaptive and elitist traits that can generate a university schedule timetable with the goal of generating a valid and as optimal as possible solution with certain constraints.

***" A Formal Model of Multi-agent System for University Course Timetabling Problems-2018"***

This paper describes a general framework of a Multi-agent system that incorporates the hyper-heuristics search methodology with both Great Deluge and Simulated Annealing acceptance criteria respectively. There are three types of agents introduced in the framework which involve the communication between heuristic agents, cooperative agents, and mediator agents.

A preliminary experiment has been conducted towards this approach in a university course timetabling problem and the results show the framework is able increase the quality of existing solutions compared with other meta-heuristics which have been studied in the previous research.

## III EXISTING SYSTEM

Existing systems for automatic timetable generation in universities typically involve advanced software solutions that utilize optimization algorithms. These systems consider a myriad of factors such as course schedules, faculty availability, room constraints, and various preferences. They often employ techniques such as genetic algorithms, simulated annealing, and tabu search to find optimal or near-optimal solutions.

One key challenge in automatic timetable generation is the complexity of the problem. The number of possible timetables grows exponentially with the number of courses, rooms, and timeslots, making it impractical to search through all possible combinations. Optimization algorithms are used to efficiently explore this vast search space and find solutions that satisfy all constraints.

Another challenge is the need to balance conflicting objectives. For example, a timetable must not only satisfy all constraints but also minimize the number of conflicts, such as overlapping classes for students or double bookings for rooms. Optimization algorithms can be tailored to prioritize certain objectives over others, allowing users to find a balance that meets their specific needs.

Additionally, automatic timetable generation systems often incorporate user-friendly interfaces that allow users to input their requirements and preferences easily. These interfaces can provide feedback on the feasibility of the input constraints and help users refine their requirements to obtain better timetables.

Overall, automatic timetable generation systems are essential tools for universities and other educational institutions, helping them efficiently schedule classes, manage resources, and meet the diverse needs of students and faculty.

***Disadvantages:***

Designing a system that accommodates all the diverse and complex scheduling requirements of different universities can be challenging.

The existing system struggles to adapt quickly to dynamic changes, such as last-minute faculty availability adjustments or unexpected events, resulting in the need for manual interventions.

## IV PROBLEM STATEMENT

Automatic timetable generation is a challenging problem, and using genetic algorithms can be a very effective approach. If you're looking to extend your project, there are several directions you could consider:

Improving Fitness Functions: Experiment with different fitness functions to see how they affect the quality of the timetables generated. You could also explore dynamic fitness functions that adapt over time.Handling Constraints: Genetic algorithms are well-suited for handling constraints. You could work on incorporating various constraints such as room availability, teacher preferences, and student preferences into your algorithm. Visualization: Develop a visualization component to display the generated timetables in a user-friendly manner, making it easier for users to understand and interact with the schedules. Parallelization: Investigate how you could parallelize the genetic algorithm to speed up the timetable generation process, especially for large datasets. Integration: Integrate your timetable generation algorithm with other software systems, such as school management systems, to automate the timetable creation process. User Interface Improve the user interface to make it more intuitive and user-friendly, allowing users to easily input their requirements and preferences

## V PROPOSED SYSTEM

The proposed system for automatic timetable generation using a genetic algorithm aims to address existing challenges and enhance the efficiency of scheduling processes in universities. Leveraging the power of genetic algorithms, the system will systematically explore the solution space to generate optimal timetables. Users will input essential data, including course details, faculty availability, room constraints, and preferences. The genetic algorithm will then iteratively evolve potential schedules, considering various constraints and objectives. The system offers adaptability to dynamic changes, allowing quick adjustments to accommodate unforeseen events or modifications. A user-friendly interface will facilitate manual interventions for administrators to review and customize generated schedules. The proposed system strives to optimize resource utilization, minimize conflicts, and provide a flexible and efficient solution to the complex task of timetable generation in university settings

***Advantages***

- User Friendly
- Reports are easily generated
- Very less paperwork
- Computer operator control
- cost efficient
- highly customizable
- easily integrated

## VI IMPLEMENTATION

***Add teachers Module*** **-**It helps us to display the names of the teachers present. The inputs taken are the ID of teachers and the names of all teachers present.

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.***Add rooms module***- This module is essential for incorporating information about available physical spaces. It ensures efficient utilization of facilities, preventing scheduling conflicts and contributing to the overall effectiveness of the timetable generation process.

***Add timings module***-This module critical for specifying the time slots available for scheduling classes. It contributes to the overall efficiency of the scheduling process, ensuring that classes are appropriately distributed within the specified time constraints.

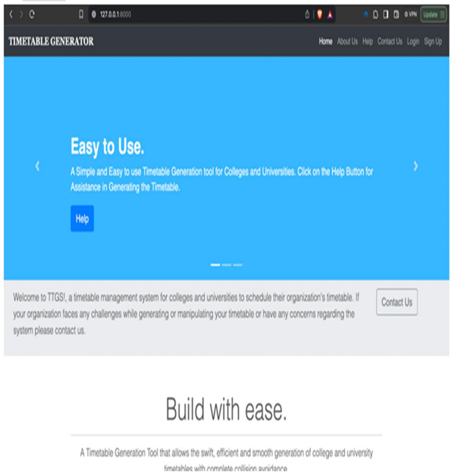
***Add courses module***-This module is essential for incorporating information about the courses offered by an institution. It ensures that the timetable reflects the diverse needs of the curriculum and contributes to the creation of a balanced and efficient schedule.

***Add departments module***-This module is crucial for incorporating information about different academic departments within an institution. It ensures that the timetable caters to the unique needs of each department, contributing to a well-organized and efficient schedule.

***Add sections module***-This module is vital for incorporating information about different student sections or groups within a course. It ensures that the timetable accommodates the diverse needs of different student groups, contributing to an organized and efficient schedule.

***Timetable generation module***-This module **is** the core component responsible for executing the algorithm and producing optimized schedules

## VII RESULST



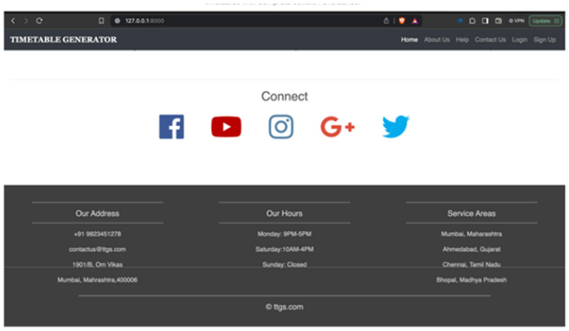
Easy to Use.

A Simple and Easy to use Timetable Generation tool for Colleges and Universities. Click on the Help Button for Assistance in Generating the Timetable.

Welcome to TTGS!, a timetable management system for colleges and universities to schedule their organization's timetable. If your organization faces any challenges while generating or manipulating your timetable or have any concerns regarding the system please contact us.

Build with ease.

A Timetable Generation Tool that allows the swift, efficient and smooth generation of college and university timetables with complete collision avoidance



Connect

| Our Address | Our Hours | Service Areas |
|---|---|---|
| +91 9823451278 | Monday: 9PM-5PM | Mumbai, Maharashtra |
| contactus@ttgs.com | Saturday:10AM-4PM | Ahmedabad, Gujarat |
| 1901/B, Om Vikas | Sunday: Closed | Chennai, Tamil Nadu |
| Mumbai, Mahrashtra,400006 | | Bhopal, Madhya Pradesh |

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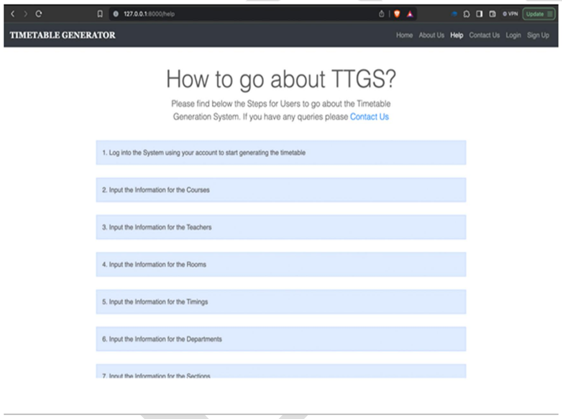
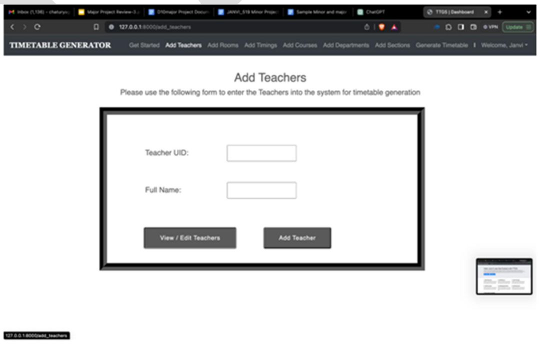


How to go about TTGS?

Please find below the Steps for Users to go about the Timetable Generation System. If you have any queries please Contact Us

1. Log into the System using your account to start generating the timetable
2. Input the Information for the Courses
3. Input the Information for the Teachers
4. Input the Information for the Rooms
5. Input the Information for the Timings
6. Input the Information for the Departments
7. Input the Information for the Sections



Add Teachers

Please use the following form to enter the Teachers into the system for timetable generation

Teacher UID:

Full Name:

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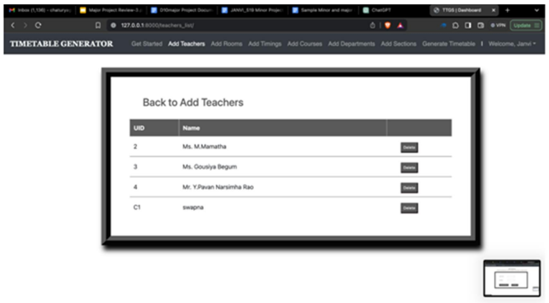
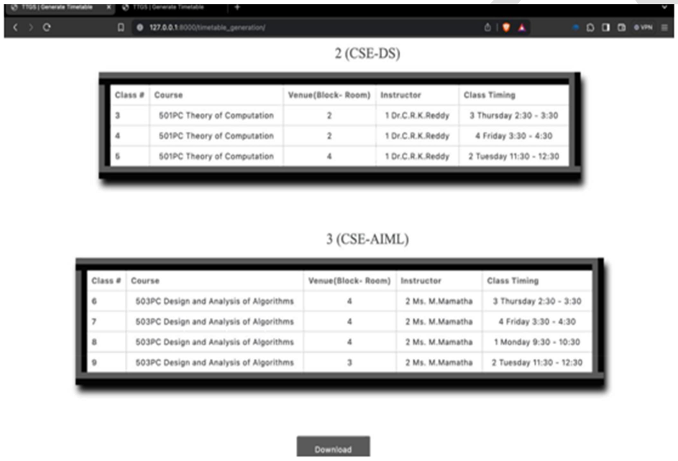


Back to Add Teachers

| UID | Name | |
|---|---|---|
| 2 | Ms. M.Mamatha | Delete |
| 3 | Ms. Gousiya Begum | Delete |
| 4 | Mr. Y.Pavan Narsimha Rao | Delete |
| C1 | swapna | Delete |


TTGS | Generate Timetable
127.0.0.1:8000/timetable_generation/

2 (CSE-DS)

| Class # | Course | Venue(Block- Room) | Instructor | Class Timing |
|---|---|---|---|---|
| 3 | 501PC Theory of Computation | 2 | 1 Dr.C.R.K.Reddy | 3 Thursday 2:30 - 3:30 |
| 4 | 501PC Theory of Computation | 2 | 1 Dr.C.R.K.Reddy | 4 Friday 3:30 - 4:30 |
| 5 | 501PC Theory of Computation | 4 | 1 Dr.C.R.K.Reddy | 2 Tuesday 11:30 - 12:30 |

3 (CSE-AIML)

| Class # | Course | Venue(Block- Room) | Instructor | Class Timing |
|---|---|---|---|---|
| 6 | 503PC Design and Analysis of Algorithms | 4 | 2 Ms. M.Mamatha | 3 Thursday 2:30 - 3:30 |
| 7 | 503PC Design and Analysis of Algorithms | 4 | 2 Ms. M.Mamatha | 4 Friday 3:30 - 4:30 |
| 8 | 503PC Design and Analysis of Algorithms | 4 | 2 Ms. M.Mamatha | 1 Monday 9:30 - 10:30 |
| 9 | 503PC Design and Analysis of Algorithms | 3 | 2 Ms. M.Mamatha | 2 Tuesday 11:30 - 12:30 |

## VIII CONCLUSION

In conclusion, the application of genetic algorithms to automatic timetable generation offers a promising solution to the complex scheduling challenges faced by educational institutions. By leveraging the principles of natural selection and genetic operations, this approach optimizes the assignment of classes, teachers, and resources, ultimately leading to well-structured and efficient timetables. The utilization of metrics such as fitness functions, room utilization, teacher workload balance, and adaptability to changes ensures the creation of schedules that adhere to diverse constraints. The genetic algorithm's ability to iteratively refine solutions over multiple generations provides an effective means of navigating the intricate scheduling landscape. As a result, the automatic timetable generation using genetic algorithms stands out as a robust and adaptable approach, addressing the limitations of manual scheduling and enhancing the overall efficiency of educational institutions. Through our research and development process, we have identified key features and functionalities that are essential for the success of such a system, including flexibility to accommodate various constraints and preferences, scalability to handle large volumes of data, and integration with existing institutional systems. Additionally, the system should prioritize fairness and transparency in scheduling to mitigate potential conflicts and ensure equal treatment of all students and staff members.

By implementing this system, academic institutions can streamline their examination processes, minimize scheduling conflicts, and improve overall operational efficiency. Furthermore, the automation of invigilation scheduling can enhance security measures and reduce the likelihood of errors or biases in assignment. Overall, the adoption of an automatic examination timetable generation and invigilation scheduling system represents a significant step forward in modernizing educational administration and enhancing the academic experience for all stakeholders involved. Furthermore, the system's invigilation scheduling module offers a comprehensive solution for assigning invigilators to exam sessions. By considering factors such as invigilator availability, expertise, and workload distribution, it ensures equitable distribution of invigilation duties while maximizing efficiency. Moreover, its automated communication features facilitate seamless coordination and communication among stakeholders, thereby reducing administrative burden and enhancing overall productivity

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