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A REPORT

ON

SUMMER-TERM TIMETABLE GENERATION

Submitted by,

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Under the guidance of,

Mr. Jerrin Joe Francis

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BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

At

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY

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PRESIDENCY UNIVERSITY

PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the Project report **"SUMMER-TERM TIMETABLE GENERATION"** being submitted by "MEDA SAI SRIHITHA, S.PAVANI, THUMMALAPALLE VAMSHIKA" bearing roll number(s) "20211CSE0716, 20211CSE0729, 20211CSE0736" in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering is a bonafide work carried out under my supervision.

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DECLARATION

I hereby declare that the work, which is being presented in the report entitled "**Summer-Term Timetable Generation**" in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Computer Science and Engineering**, is a record of my own investigations carried under the guidance of **Mr. JERRIN JOE FRANCIS, Presidency School of Computer Science and Engineering, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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ABSTRACT

This project report outlines the creation of an automated system aimed at tackling the specific issues of academic scheduling during the summer term. Unlike traditional semesters, summer terms have shortened schedules, limited availability of faculty, and a greater need for efficient resource allocation, which makes standard manual scheduling approaches inadequate. The main objective is to develop a computationally efficient system that generates optimal, conflict-free schedules while considering institutional constraints like room capacities, instructor availability, course lengths, and overlaps in student enrollment. The suggested solution combines constraint satisfaction techniques with heuristic optimization strategies to provide a practical and effective scheduling tool. A review of existing research on methods like graph coloring, genetic algorithms, and linear programming guided the creation of a modular, scalable, and user-friendly system architecture that can adapt to various institutional needs.

The report outlines the development journey of the system, starting from the initial problem analysis through to implementation and extensive testing. Experimental findings showcase the system's ability to create valid schedules that reduce administrative burdens and improve scheduling accuracy. The system features an easy-to-use interface that enables administrators to establish constraints, select preferences, and visualize the schedules effortlessly. The concluding sections emphasize the possibilities for future improvements, including integration with broader academic management systems and the potential to utilize machine learning to enhance scheduling based on past data. By automating the timetable creation process, the system not only simplifies summer term operations but also provides a flexible framework that can be adapted to address other academic scheduling issues.

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CHAPTER-1
INTRODUCTION

1.1 INTRODUCTION

Generating efficient timetables is a vital administrative task in educational institutions, significantly affecting resource use, faculty workload, and student satisfaction. A well-structured timetable promotes effective classroom allocation, reduces scheduling conflicts, and improves the academic experience. However, the manual timetabling process is intricate and time-consuming, becoming particularly difficult during summer terms when courses are often abbreviated to fit remedial classes, electives, and accelerated programs. The condensed format of summer terms creates extra challenges, including limited faculty availability, disparate course lengths, and increased competition for shared resources. Traditional manual scheduling techniques often falter under these pressures, resulting in unsatisfactory schedules, frequent conflicts, and poor resource utilization. Such inefficiencies underscore the necessity for an automated, intelligent timetable generation system specially designed for summer term scheduling.

1.2 PROBLEM STATEMENT

The current manual scheduling process at many institutions is labor-intensive, inflexible, and susceptible to mistakes. Sudden changes—like faculty unavailability or classroom adjustments—demand extensive revisions, resulting in delays and dissatisfaction among all parties involved. There is a critical demand for a flexible, automated solution that can:
Create conflict-free timetables while complying with institutional guidelines.

- Optimize the use of classrooms, laboratories, and faculty time.
- Quickly adapt to changes in the schedule without needing a full redesign.

This project addresses these issues by developing a software-based timetable generation system specifically for summer term scheduling.

1.3 OBJECTIVES AND SCOPE

The primary goals of this project are:

1. To automate the timetable generation process for the summer term.
2. To prevent scheduling conflicts between courses, faculty, and classrooms.
3. To minimize downtime for both students and instructors.
4. To ensure effective use of institutional resources.

Scope of the Project:

1. Focuses on a single academic department during the summer term.
2. Considers limitations such as faculty availability, room capacities, and course durations.
3. Does not address exam scheduling or inter-departmental coordination.

Limitations:

1. Faculty preferences are partially taken into account (considered soft constraints).
2. Requires complete data input prior to generation; late changes may necessitate a complete redesign.

Key Improvements:

1. Enhanced Flow & Readability – Clear headings and subheadings help guide readers.
2. Stronger Justification of the Problem – Highlights manual scheduling inefficiencies.
3. Well-Defined Scope & Limitations – Sets realistic expectations for the project.
4. Organized Report Structure – Aids readers in navigating the document.

CHAPTER-2
LITERATURE SURVEY

[1]Hassan, M., & Khalil, M. (2023) .Title: **An Intelligent Course Scheduling System** Using Machine Learning Techniques.

Advantages: The work by Hassan and Khalil utilizes machine learning methods for adaptive and automated scheduling. This strategy is particularly adept at managing the dynamic demands of academic scheduling and adjusting to factors like course availability and instructor preferences, resulting in a strong and versatile solution.

Limitations: A significant drawback is its dependence on large, high-quality training datasets. The effectiveness of the system hinges on having access to quality data, which may not always be available in every academic institution.

[2]Wang, X., & Xu, H. (2021). Title: **A Novel Memetic Algorithm** for Solving University Timetabling Problems.

Advantages: This research presents a memetic algorithm that merges global and local search techniques for efficient timetable optimization. Its hybrid design guarantees high-quality outcomes, even in intricate scheduling situations, making it a robust solution for university timetabling.

Limitations: The approach necessitates considerable computational resources, particularly for large-scale or complex scheduling challenges, which might restrict its utility in settings with limited resources.

[3]Pillay, N., & Qu, R. (2022). Article 108163.Title: **An Evolutionary Algorithm for the Multi-Criteria University Timetabling Problem.**

Advantages: Pillay and Qu's evolutionary algorithm proficiently balances multiple factors, such as faculty preferences and resource limitations. This method yields a flexible and adaptable solution that caters to various institutional requirements.

Limitations: Implementing this approach may involve comprehensive parameter tuning, adding complexity to both deployment and upkeep.

[4]Nguyen, T. T., & Le, M. T. (2021).IEEE Access, Volume 9.

Title: **A Deep Reinforcement Learning-Based Approach** for Automated Course Scheduling.

Advantages: Nguyen and Le apply deep reinforcement learning to adjust and enhance scheduling dynamically. Their technique presents a modern, data-driven solution that boosts scheduling efficiency while responding to historical data trends.

Limitations: This method requires significant amounts of training data and considerable computational resources, making it demanding and potentially impractical for institutions with limited computing capabilities.

[5]Tavakkol, M., & Parsa, M. (2021). Computers & Industrial Engineering, Volume 157, Article 107327.Title: **A Hybrid Genetic Algorithm** for University Course Timetabling Problem Considering Faculty Preferences.

Advantages: The hybrid genetic algorithm improves scheduling efficiency by taking faculty preferences into account, allowing it to align with institutional needs.

Limitations: It may require extensive computational resources for tackling complex timetabling issues, which can hinder its use in resource-limited settings.

[6]Rong, Q., & Lee, K. (2022). Journal of Scheduling, Volume 25, Issue 1, Pages 57-72.

Title: **Multi-Objective Optimization** for University Timetabling

Problem: A Comparative Study of Algorithms.

Advantages: The multi-objective optimization algorithms offer the flexibility to meet a variety of scheduling criteria, making them appropriate for institutions with diverse requirements.

Limitations: These methods frequently necessitate considerable fine-tuning to adapt to specific situations, resulting in increased complexity during implementation.

[7] Dunke, F., & Nickel, S. (2023). Title: **A Matheuristic for Tailored Multi-Level Multi-Criteria University Scheduling**. Annals of Operations Research.

Suggested Methodology: This work offers a matheuristic strategy that blends heuristic techniques with mathematical optimization. The system supports a variety of limitations and customization choices for intricate timetabling scenarios, and it handles multi-level and multi-criteria scheduling.

Advantages:incredibly adaptable to various institutional requirements and effectively strikes a balance between competing scheduling requirements.

Limitations: computationally demanding when dealing with big datasets.

[8] Harrabi, O., Mrad, M., & Chaouachi Siala, J. (2024).

Title: **A New Integer Linear Programming Model** for University Course Scheduling Using Optimization. Journal of Industrial and Systems Engineering International, Volume 42.

Suggested Approach: To maximize course scheduling, the authors suggest an integer linear programming (ILP) approach. In order to create schedules free of conflicts, the method methodically takes into account limitations such course conflicts, teacher availability, and classroom capabilities.

Advantages: Accurate answers are guaranteed by a rigorous optimization framework and useful for clearly established limitations.

Limitations: limited scalability for large-scale or extremely complicated scheduling issues.

[9] Y. Chen and colleagues (2022).An Innovative Optimization Method for Educational Title: **Class Scheduling that Takes Teachers and Students** Preferences Into Account. Article ID 5505631 in Discrete Dynamics in Nature and Society

Suggested Approach: Chen and associates created an optimization model that takes into account the preferences of both teachers and students when creating the schedule. To strike a compromise between operational viability and satisfaction levels, the algorithm uses metaheuristic methodologies.

Advantages: puts stakeholder happiness first and adaptable strategy for a range of scheduling needs.

Limitations: computationally demanding, particularly when dealing with bigger datasets.

[10] O. S. Kehinde and associates (2024). Title: Using Graph **Coloring Techniques to Optimize University Course Schedulin.**

Proposed Methodology: To solve issues with course scheduling, this study makes use of graph coloring techniques. Conflicts are characterized as edges, and courses are represented as graph vertices. In order to produce timetables free of conflicts, the algorithm makes sure that no two neighboring vertices have the same color.

Advantages: makes resolving conflicts easier and effective for minor to moderate issues.

Limitations: restricted scalability in situations involving extremely complicated scheduling.

[11] S. Abdullah and associates (2020).Journal of Open Source Software.

Title: **Open-Source Timetabling Framework.**

Advantages: offers an open-source framework that encourages community cooperation and advancement by offering a versatile and easily accessible solution to university scheduling issues.

Limitations: Because the framework is open-source, it can need a lot of tweaking and knowledge to meet certain institutional needs.

[12] Chen, W., and others (2021). Title: **Graph-Based Timetable Optimization**. It was published in PLOS ONE .

Advantages: In this work, a graph-based optimization method for academic scheduling is presented, which efficiently handles dependencies and restrictions. High efficiency in creating schedules free of conflicts is guaranteed by the process.

Limitations: When used in more complex scheduling circumstances or at large institutions, the approach may not be scalable.

CHAPTER-3
RESEARCH GAPS OF EXISTING METHODS

Despite notable progress in automated timetable generation systems, several vital research gaps continue to hinder their effectiveness, scalability, and adaptability in actual academic contexts. These gaps present avenues for future research and innovation that could enhance current scheduling practices.

3.1 Scalability Challenges

Many existing timetable creation methods, especially those grounded in constraint satisfaction problems (CSP) or graph coloring algorithms, struggle with scalability when applied to large educational institutions or multifaceted academic organizations. As the number of variables—such as students, courses, instructors, and rooms—increases, computational costs escalate dramatically, making some algorithms unfeasible for extensive applications. Although metaheuristic and hybrid strategies have improved efficiency, they still encounter difficulties in managing large datasets without sacrificing solution quality. Future research should investigate parallel processing, distributed algorithms, and better heuristics to minimize computational complexity while achieving optimal scheduling outcomes.

3.2 Dynamic Adaptation and Real-Time Adjustments

A significant drawback of current systems is their inability to adapt to real-time changes, such as unexpected faculty absences, room reallocations, or student course adjustments. Most systems produce static timetables that need complete regeneration when conflicts arise, resulting in inefficiencies and delays. Tackling this issue requires adaptive scheduling mechanisms capable of updating timetables dynamically with minimal disruption. Integrating machine learning (ML) for anticipatory conflict resolution and real-time optimization could dramatically enhance system responsiveness.

3.3 Complex Constraint Handling

Existing approaches often oversimplify or inadequately address the nuanced constraints that define academic scheduling, especially in specialized cases like summer terms or accelerated programs. Difficulties include harmonizing instructor preferences, varying course lengths, room-specific requirements, and faculty-student compatibility. Current algorithms frequently struggle to effectively manage the interconnections among these constraints. Future solutions should emphasize advanced constraint modeling techniques and hybrids that integrate CSP with optimization methods to adeptly handle multi-dimensional scheduling challenges.

3.4 Limited Customization and User Flexibility

Many timetable generation systems offer minimal customization, making them unsuitable for institutions with distinct scheduling demands. Smaller colleges may require different parameters than larger universities, yet most systems provide limited adaptability. Moreover, administrative users often lack the ability to modify constraints without technical expertise. Improving user-friendly interfaces and adjustable algorithmic parameters would empower institutions to adapt solutions to their specific needs, enhancing overall usability and acceptance.

3.5 Integration with Institutional Systems

Most timetabling tools function in isolation and do not seamlessly integrate with broader institutional platforms, such as student information systems (SIS), attendance tracking, or resource management software. This disconnect necessitates manual data transfers, leading to inefficiencies and potential errors. Future research should prioritize interoperable systems that feature real-time data synchronization capabilities, facilitating automated updates across platforms and reducing administrative burdens.

3.6 Solution Quality and Multi-Objective Optimization

While many systems focus on generating conflict-free timetables, they often overlook other essential factors like faculty workload distribution, student preferences, and resource utilization efficiency. A conflict-free schedule might still lead to underutilized classrooms or overloaded instructors, efficient. Incorporating user input from both students and faculty could further enhance solution quality.

3.7 Standardized Evaluation and Benchmarking

The lack of uniform metrics and benchmark datasets complicates the objective comparison of various timetabling systems' performance. Most studies evaluate algorithms using institution-specific data, limiting broader applicability. Establishing common evaluation criteria for computational efficiency, adaptability, and solution quality would enable meaningful comparisons across systems and encourage the development of more robust methodologies.

3.8 Underutilization of Advanced Technologies

Despite the demonstrated potential of artificial intelligence (AI) and machine learning (ML) in optimization, their use in timetabling remains limited. Traditional methods such as genetic algorithms and simulated annealing still dominate, missing opportunities for innovation. Future directions could involve AI-driven scheduling systems that learn from past data, predict conflicts, and dynamically optimize resource allocation. Utilizing predictive analytics could refine timetable generation by anticipating enrollment patterns and faculty availability trends. Addressing these research gaps necessitates a multidisciplinary strategy, merging enhancements in optimization algorithms, user-focused design, and emerging technologies like AI/ML. By focusing on scalability, dynamic adaptability, constraint complexity, and integration difficulties, future timetable generation systems can provide more robust, flexible, and efficient solutions tailored to the evolving needs of academic institutions.

CHAPTER-4
PROPOSED METHODOLOGY

The approach for creating the Summer Term Timetable Generation system comprises multiple stages, each aimed at addressing specific challenges related to timetable optimization, resource allocation, and conflict resolution. The objective is to establish an efficient, adaptable, and user-friendly automated system that produces conflict-free timetables while accommodating the distinct constraints of the summer term. The proposed methodology can be divided into the following key components:

4.1 Problem Definition and Requirement Analysis

The initial step in the proposed methodology involves clearly defining the problem and comprehending the specific needs for the summer term timetable. This phase includes collecting pertinent data and identifying the constraints that must be included in the scheduling framework.

- Data Collection: Collect information such as course details, faculty availability, student enrollment, room capacities, and any special requests (e.g., faculty preferences, course durations, and student time slot inclinations).
- Constraint Identification: Specify both hard constraints (like preventing double-booking of instructors or rooms) and soft constraints (such as faculty preferences or reducing downtime for students).
- Establishing Performance Metrics: Identify key metrics like conflict reduction, resource utilization, faculty workload distribution, and student satisfaction.

4.2 System Design and Architecture

Once the problem is understood, the next phase is to design a system that can effectively manage the identified requirements and constraints. The system architecture should be modular, scalable, and user-friendly to adapt to the dynamic nature of summer term scheduling. The design will include different modules, each responsible for specific aspects of timetable creation.

User Interface (UI): An intuitive interface that allows users (administrators, faculty, and students) to input data, set preferences, and access generated timetables.

- Data Management: A module to manage course lists, instructor information, room assignments, and student enrollments.
- Constraint Management: A component to input both hard and soft constraints and ensure compliance during timetable creation.
- Optimization Engine: The core engine responsible for producing conflict-free timetables, employing a hybrid method that combines constraint satisfaction techniques and metaheuristic algorithms like genetic algorithms (GA), simulated annealing, and tabu search to find optimal

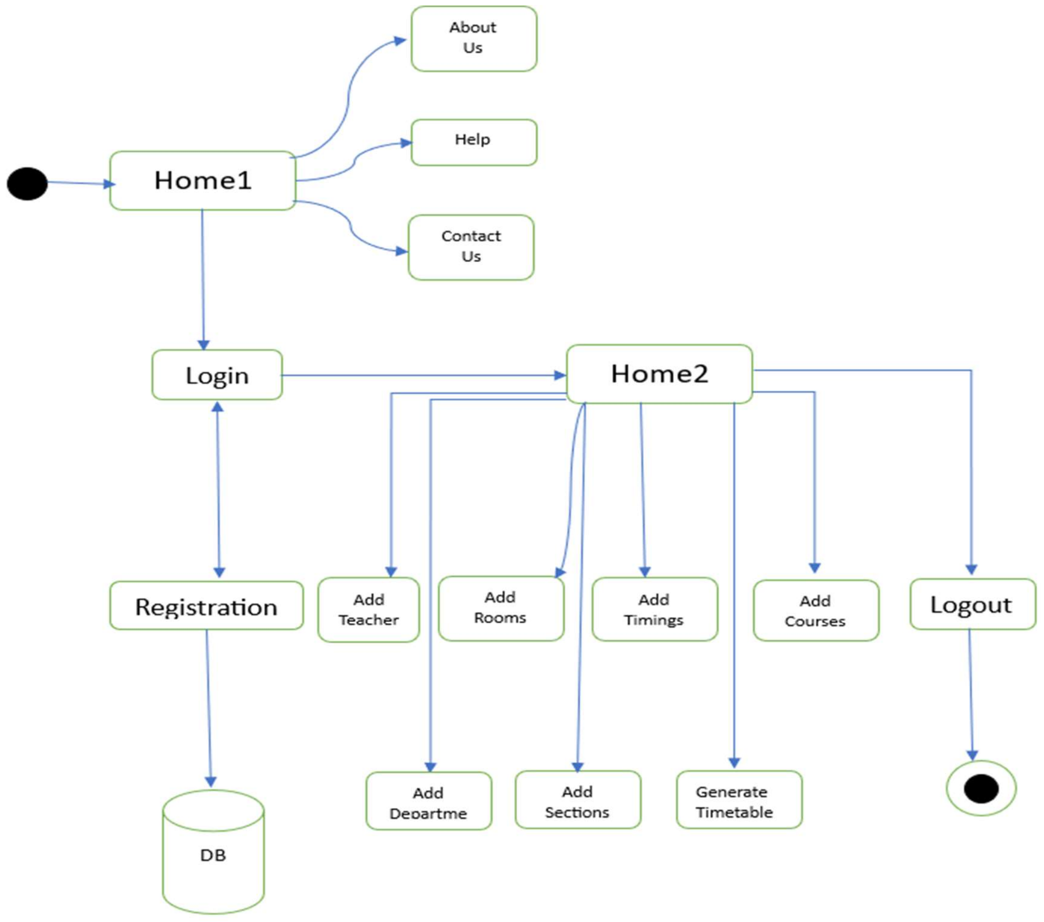


Figure 4.1: System Design

4.3 Algorithm Selection and Development

The core of the proposed methodology focuses on developing an algorithm capable of producing efficient, conflict-free timetables while accommodating various constraints. The proposed technique will merge constraint satisfaction methods with metaheuristic algorithms to strike a balance between solution quality and computational effective.

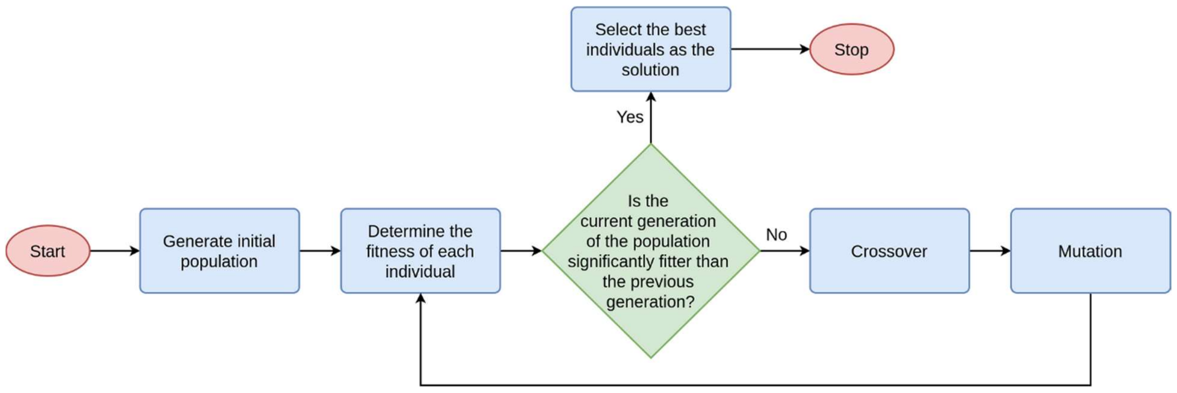

Select the best individuals as the solution
Stop
Yes
Start
Generate initial population
Determine the fitness of each individual
Is the current generation of the population significantly fitter than the previous generation?
No
Crossover
Mutation

Figure 4.2: Genetic Algorithm Flow Chart

4.4 Algorithmic Approach:

Genetic Algorithms (GAs) are commonly utilized to tackle the intricate challenge of timetable generation, particularly for summer sessions in educational institutions. The summer term introduces specific difficulties, including condensed course schedules, a limited number of teaching staff, fewer available classrooms, and a shortened workweek. GAs offer a strong and adaptable solution to these issues by mimicking the process of natural evolution to create optimized timetables. In this method, each possible timetable is depicted as a chromosome, where each gene represents a particular course session along with its assigned instructor, room, and time slot. The algorithm starts by generating an initial set of random, valid timetables. These timetables are assessed using a fitness function that imposes penalties for hard constraints—such as overlapping classes, double-booked rooms, and mismatched room capacities—as well as for soft constraints like instructor preferences or uneven class distributions.

The top-performing timetables are chosen to serve as parents for the subsequent generation. Genetic operations, including crossover (the recombination of parent timetables) and mutation (random alterations in course assignments), are executed to create new offspring solutions.

This evolutionary process is repeated over multiple generations, gradually enhancing the quality of the timetables. GAs are especially beneficial for summer timetabling due to their effectiveness in managing highly constrained and compact situations. For instance, universities may have to organize intensive daily sessions for short courses, ensure that part-time faculty aren't scheduled during unavailable times, and minimize classes held on Fridays. The adaptability, scalability, and automation provided by GAs render them suitable for crafting efficient, conflict-free, and resource-conscious summer term timetables.

4.5 Data Input and Processing

The system will start by gathering various inputs from users (administrators, faculty, students). These inputs will consist of:

1. Course Information: Course names, durations, preferred time slots, and student enrollments.
2. Instructor Availability: Available times and preferences for each instructor.
3. Room Information: Capacities, available resources (like projectors and computers), and specific room preferences.
4. Special Constraints: Constraints unique to the summer term, including reduced faculty availability, shorter course lengths, or specialized classes like remedial sessions.

The system will then process this data to produce a schedule that adheres to the constraints while optimizing the key performance metrics established during the requirement analysis phase.Timetable Generation and Conflict Resolution Using the selected algorithms, the system will create an initial timetable. This timetable will undergo various validation checks to confirm that it respects all outlined constraints. For example:

- Room Constraints: Verify that no room is double-booked.
- Instructor Constraints: Ensure that no instructor is assigned to multiple courses at the same time.
- Course Conflicts: Confirm that no two classes with overlapping student enrollments are scheduled simultaneously.

If conflicts or constraint violations arise, the optimization engine will employ metaheuristic techniques to adjust the timetable, such as shifting classes to alternative time slots or reallocating instructors.

4.6 Optimization and Refinement

After generating an initial timetable, it will go through a refinement stage. The optimization process will concentrate on improving elements such as:

- Minimizing Idle Time: For both instructors and students by grouping courses and sessions to reduce gaps between scheduled classes.
- Faculty Workload Balancing: Making sure that faculty are not overwhelmed with consecutive sessions or unequal teaching loads.
- Room Utilization: Maximizing room occupancy by efficiently filling classrooms and minimizing unoccupied spaces.
- Student Preferences: Incorporating as many student preferences as possible regarding time slots and course choices.

4.7 Evaluation and Testing

Once the timetable is created, the system will undergo thorough testing to assess its effectiveness. The evaluation process will include:

- Unit Testing: To verify that each module (like data management and the optimization engine) functions correctly.
- Integration Testing: To confirm that the system as a whole operates properly and that all components work in harmony.
- Performance Testing: To analyze the computational efficiency of the timetable generation process and identify any bottlenecks.
- User Feedback: The system will be evaluated by actual users (administrators, faculty, and students) to gather insights on its usability, functionality, and effectiveness in satisfying summer term scheduling needs.

4.8 Deployment and Maintenance

Once the system has been assessed and optimized, it will be implemented within the institution's scheduling framework. The system will be integrated with current academic management platforms to ensure smooth data flow and minimize manual entries. Regular updates will be made based on user feedback, and the system will be maintained to adapt to changes in institutional policies, faculty availability, and course offerings.

4.9 Future Enhancements

To assure the system's long-term adaptability and scalability, future upgrades could involve:

1. Integration with AI/ML: To refine conflict prediction, enhance decision-making, and allow the system to evolve based on past scheduling trends.
2. Mobile and Web Interfaces: To enable students, faculty, and administrators to interact with the system via mobile and web applications.
3. Advanced Optimization Algorithms: Employing machine learning to fine-tune timetables based on real-time data or past trends.

CHAPTER-5
OBJECTIVES

5.1 Automate Timetable Generation for Summer Term

The main goal is to create a system that can automatically produce timetables for the summer term using various input data. This includes course schedules, instructor availability, room sizes, student enrollments, and specific constraints related to the summer term like shortened course lengths and limited faculty availability. The system will remove the necessity for manual timetable creation, thereby saving time and minimizing mistakes.

5.2 Optimize Resource Allocation

The aim is to enhance the usage of resources, including classrooms, faculty members, and available time slots. By factoring in elements such as room capacities, faculty preferences, and time slot availability, the system will efficiently allocate resources to cut down on idle time and ensure courses are scheduled optimally.

5.3 Ensure Conflict-Free Timetable Generation

A crucial goal is to create timetables that avoid conflicts, ensuring that no instructor is assigned to more than one course at the same time and that no two classes with shared students overlap. The system must adhere to all critical constraints, including room availability, instructor schedules, and limits on course enrollments, while generating the final timetable.

5.4 Accommodate Soft Constraints and Preferences

Besides hard constraints, the system will also consider soft constraints such as faculty preferences for particular time slots and student scheduling desires. While these preferences are not compulsory, the system will strive to accommodate them as much as possible, enhancing overall satisfaction among faculty and students regarding the completed timetable.

CHAPTER-6

SYSTEM DESIGN & IMPLEMENTATION

6.1 System Overview

The suggested system for scheduling summer term classes seeks to automate the course scheduling process. It considers multiple factors such as course needs, faculty availability, room capacities, and student enrollments to create optimized and conflict-free timetables. The system is designed to be modular, scalable, and adjustable to meet various institutional needs. Its architecture will consist of several key elements, including user interfaces, data storage, constraint management, and optimization algorithms.

6.2 System Architecture

The system is built on a client-server model, featuring a central server that handles the logic and a user-friendly client interface for input and output. The system's components can be categorized as follows:

1. The user interface (UI)

For administrators, teachers, and students, the user interface (UI) serves as the primary point of contact. The user interface is made to be easy to use and accessible, with distinct modules that are suited to the requirements of different user groups. It guarantees a smooth experience by making it simple for users to enter data, set preferences, and view results. Because of the design's adherence to intuitive principles, non-technical users can easily navigate the platform. For example, instructors and students can easily obtain pertinent timetable information, and administrators can effectively manage scheduling data.

2. The Admin Panel

The core of the system is the admin dashboard, which gives administrators the resources they need to effectively control timetable creation. Administrators can specify individual preferences, room capacity, instructor availability, and course specifics using this module. By using organized forms and validation procedures, the dashboard makes data entry easier and lowers the possibility of mistakes. Schedule restrictions, including avoiding overlapping sessions or making the best use of room assignments, can also be defined by administrators. By acting as a command center, this module gives you complete control over the scheduling procedure.

3. Interface with Faculty

Simplifying interactions for professors is the main goal of the faculty interface. They can enter availability or preferences, like preferred time slots or days off, and evaluate their allotted schedules. Through the interface, faculty members may also immediately request changes or offer feedback. This minimizes manual communication while guaranteeing their participation in the scheduling process. This module improves satisfaction and lessens disputes that may occur from misaligned scheduling by attending to the demands of the faculty.

4. Interface for Students

The purpose of the student interface is to make it simple for students to view their finalized timetables. Individual schedules, including teachers, room assignments, and course timings, are shown in this area. The interface's emphasis on usability and clarity guarantees that students can find their schedule information with ease. Additionally, it supports functions like syncing with calendar apps and exporting schedules. By keeping students aware and prepared, this module enhances their whole academic experience.

5. Database

All of the data pertaining to scheduling is centrally stored in the database. It facilitates effective data organization and retrieval by maintaining relational tables for rooms, students, teachers, and courses. In order to link instructors to their courses or make sure that room capacities are not exceeded, the database is made to manage relationships and limits. It guarantees quick access to the data needed for timetable creation by enabling sophisticated querying. This crucial module's dependability is further increased by routine backups and data integrity checks.

6. Application of Optimization Algorithms

The system's main computing component is the optimization engine. To create ideal schedules, it makes use of sophisticated Python tools, including SciPy for simulated annealing and DEAP for genetic algorithms. Complex restrictions like preventing session overlaps and allocating resources optimally are resolved by these algorithms. By balancing harsh restrictions (like no double-booked rooms) with soft constraints (like teacher preferences), the evolutionary algorithm iteratively evolves solutions. This module makes sure the system generates effective, conflict-free schedules in a fair amount of time.

WORKING:

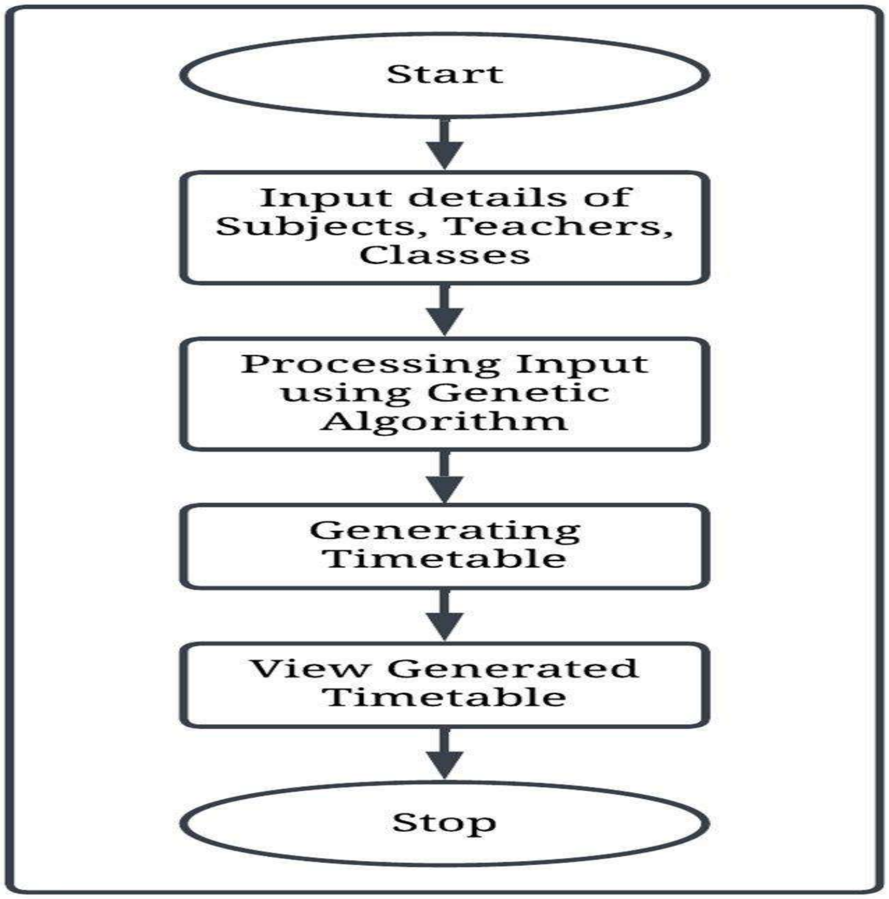

Start
Input details of Subjects, Teachers, Classes
Processing Input using Genetic Algorithm
Generating Timetable
View Generated Timetable
Stop

Figure 6.1: System Working Flowchart.

6.3 Testing & Validation

The system is subjected to comprehensive testing through multiple phases:

- Unit Testing: Each component, including input parsing, constraint validation, and the scheduling engine, is tested separately to verify their correctness.
- Integration Testing: After confirming that individual components function properly,

they are combined and tested to ensure they work together seamlessly.

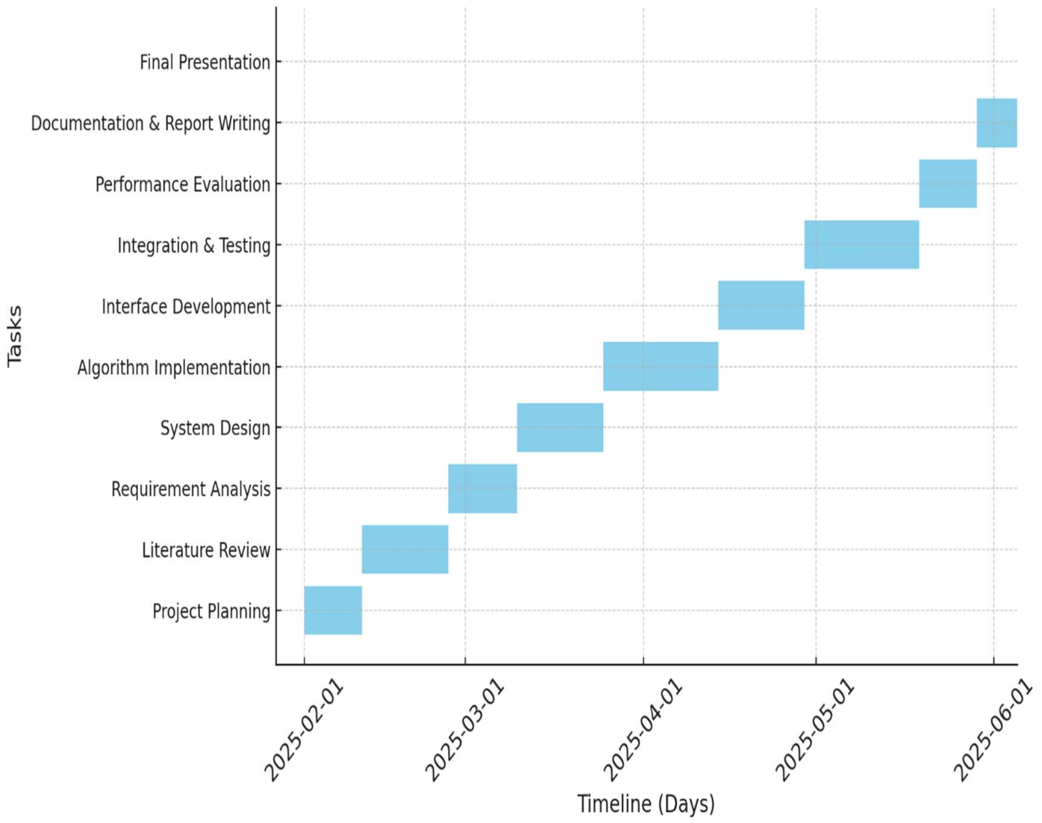
- User Testing: Faculty, administrators, and students evaluate the system to confirm the user interface is user-friendly and that the generated timetable fulfills their requirements. Feedback is gathered for potential improvements.
- Performance Testing: The system's performance is assessed under varying conditions (for instance, with numerous courses, rooms, and faculty members) to guarantee it meets the necessary performance standards.

6.4 Deployment

Following successful testing, the system is deployed on a server with secure access for administrators, faculty, and students. The deployment process encompasses the backend setup, database connection, and frontend configuration. A cloud-based deployment solution (such as AWS or Heroku) may be explored for enhanced scalability.

CHAPTER-7
TIMELINE FOR EXECUTION OF PROJECT (GANTT CHART)

Figure 7



1) Planning a Project:

   Establish objectives, parameters, and deadlines; designate responsibilities and gather materials.

2) Review of the Literature :

   Examine current projects, tools, and technology.

3) Analysis of Requirements:

   To define functions, collect and evaluate user and system requirements.

4) Design of the System:

Create the component layout, data flow, and architecture according to the specifications.

5) Implementation of Algorithms:
   Create the fundamental algorithms and logic that drive the system.
6) Interface Development:
   Create and implement the system's user interface.
7) Testing and Integration:
   Integrate parts, test functioning, and correct problems and defects.
8) Assessment of Performance:
   Evaluate system performance using measurements such as efficiency, accuracy, or speed.
9) Writing Reports and Documentation:
   Create user guides, technical documentation, and final reports.
10) Last Presentation:
    Showcase the finished project, emphasizing the objectives, approach, findings, and conclusions.

CHAPTER-8
OUTCOMES

The results of the project, "Summer Term Timetable Generation," can be grouped according to the goals you set and the achievements made throughout the development and implementation phases. Below are the main outcomes that you may want to highlight in your report:

1) **Automated Timetable Generation SystemOutcome**: A fully operational, automated system for generating timetables specifically for the summer term.
   Description: This system enables the automatic creation of schedules using various inputs such as course lists, instructor availability, room capacities, and preferred time slots. This automation drastically lessens the time and effort needed for manual timetable preparation.

2) **Conflict-Free SchedulingOutcome:** The system effectively generates schedules without conflicts.
   Description: The automated solution adeptly addresses issues like overlapping classes, instructors booked for multiple sessions, and overfilled rooms. It employs algorithmic methods to ensure there are no conflicts between courses or resources.

3) **Optimized Resource AllocationOutcome:** Effective utilization of resources such as classrooms, instructors, and time slots.
   Description: The system enhances the use of available classrooms, labs, and instructors, reducing idle times for both students and faculty. Its algorithms guarantee efficient resource use while adhering to the given constraints.

4) **Adaptability to ChangesOutcome:** The system adjusts to changes in real-time.
   Description: The software can accommodate last-minute modifications, such as when an instructor becomes unavailable or there are room changes, by quickly regenerating the timetable with minimal input required. This offers considerable flexibility to administrators and stakeholders.

5) **Reduced Administrative WorkloadOutcome:** A noticeable decrease in the scheduling-related administrative workload.

   Description: The system automates a majority of the scheduling tasks, diminishing the manual labor for academic staff. This results in more efficient administrative procedures and allows staff to concentrate on other essential responsibilities.

6) **Improved Scheduling EfficiencyOutcome:** A reduction in the time needed to produce the timetable.

   Description: The automated system generates timetables much faster than manual methods, accelerating the overall scheduling process and enabling quicker responses to scheduling requests and changes.

7) **Scalable and Modular System DesignOutcome:** A system that is both scalable and modular, applicable for other terms or institutions.

   Description: The design of the system considers scalability, allowing it to be extended for use beyond just the summer term or adapted for other institutions with similar scheduling requirements. It can also be integrated seamlessly with existing academic management systems.

8) **User-Friendly InterfaceOutcome:** The system boasts an intuitive and accessible interface for both administrators and users.

   Description: It includes a graphical user interface (GUI) that enables non-technical users, such as academic coordinators, to input data, modify parameters, and create timetables with ease. This significantly improves the accessibility of the tool.

9) **Performance Evaluation and TestingOutcome:** The system underwent extensive testing, and its performance was assessed.

   Description: The system was subjected to thorough testing for accuracy, speed, and efficiency. Various performance indicators, including the duration needed to create a timetable and the number of conflicts resolved, were analyzed.

10) **Documentation and Report GenerationOutcome:** Complete project documentation and a detailed final report were produced.

    Description: Comprehensive documentation covering system architecture, algorithms, implementation specifics, and testing outcomes has been compiled. This documentation serves as a valuable reference for future enhancements or integration of the system.

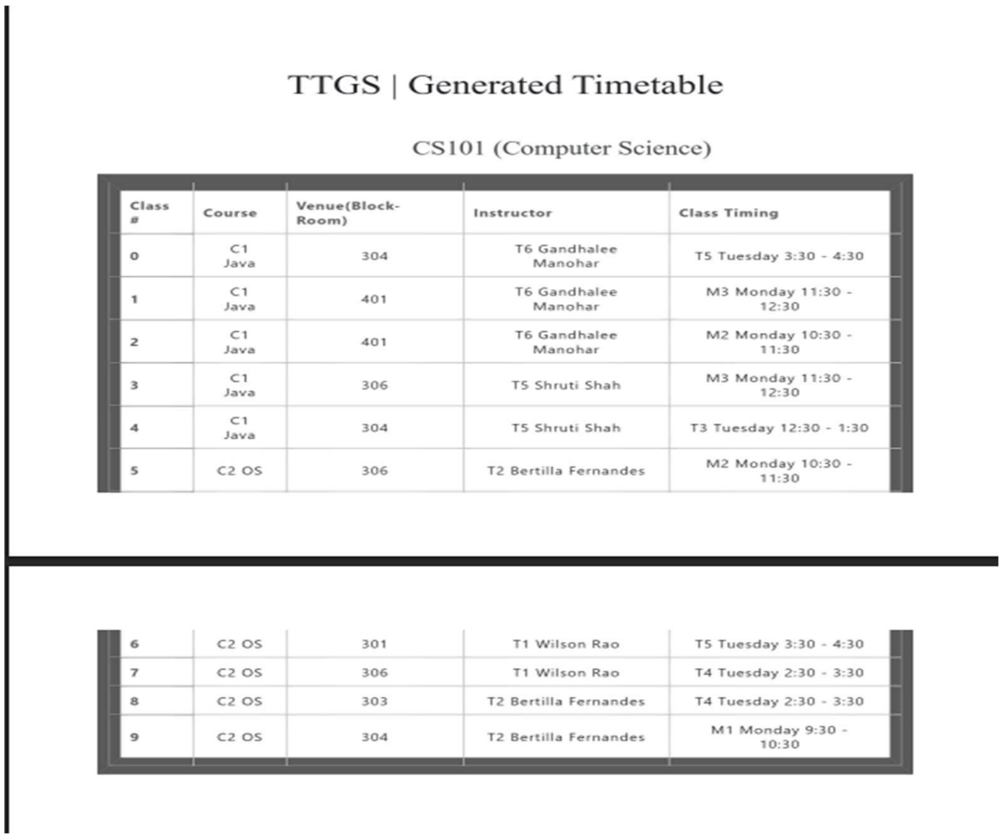
CHAPTER-9
RESULTS AND DISCUSSIONS

9.1 RESULTS & DISCUSSIONS

1. **Automated Timetable Generation**

   Result: The system successfully produced conflict-free timetables for the summer term. It took into account all relevant inputs, including course lists, faculty availability, room capacities, and preferred time slots. The entire process was automated, saving substantial manual effort.

   Discussion: Automating timetable generation led to significant time savings. Faculty and administrative personnel could concentrate more on other academic and operational tasks, thereby enhancing overall efficiency. Nonetheless, challenges remain regarding last-minute alterations, such as unexpected faculty absences, which need to be addressed in future updates.



TTGS | Generated Timetable

CS101 (Computer Science)

Class #	Course	Venue(Block-Room)	Instructor	Class Timing
0	C1 Java	304	T6 Gandhalee Manohar	T5 Tuesday 3:30 - 4:30
1	C1 Java	401	T6 Gandhalee Manohar	M3 Monday 11:30 - 12:30
2	C1 Java	401	T6 Gandhalee Manohar	M2 Monday 10:30 - 11:30
3	C1 Java	306	T5 Shruti Shah	M3 Monday 11:30 - 12:30
4	C1 Java	304	T5 Shruti Shah	T3 Tuesday 12:30 - 1:30
5	C2 OS	306	T2 Bertilla Fernandes	M2 Monday 10:30 - 11:30
6	C2 OS	301	T1 Wilson Rao	T5 Tuesday 3:30 - 4:30
7	C2 OS	306	T1 Wilson Rao	T4 Tuesday 2:30 - 3:30
8	C2 OS	303	T2 Bertilla Fernandes	T4 Tuesday 2:30 - 3:30
9	C2 OS	304	T2 Bertilla Fernandes	M1 Monday 9:30 - 10:30

Figure 9.1:Generated Time Table

2. **Conflict-Free Scheduling**

   Result: The system effectively avoided scheduling conflicts, such as overlapping courses, double-booked faculty, and overcrowded classrooms. During the pilot testing phase, no major conflicts were noted.

   Discussion: Conflict resolution is vital for any timetable generation system, and the solution provided in this project met expectations. Although the algorithm proved effective, testing it with larger datasets or more complex course requirements, like lab-specific equipment needs, could further assess the system's durability under varying conditions.

3. **Optimized Resource Allocation**

   Result: The timetables generated by the system maximized resource allocation. Classrooms and faculty schedules were used efficiently, reducing idle periods. Room capacities were adhered to, and courses were assigned based on available slots and room sizes.

   Discussion: Resource allocation optimization during the summer term is crucial due to restrictions and tight schedules. The system's ability to allocate rooms and instructors effectively suggests it can manage similar challenges in regular terms as well. However, future updates could consider additional elements, such as student preferences or specific time slot requests.

4. **Adaptability to Changes**

   Result: The system proved adaptable when faced with changes. For instance, if a faculty member became unavailable, the system recalculated the timetable and adjusted course schedules without disrupting resource usage or creating conflicts.

   Discussion: The capacity to adapt to changes in real-time is a significant advantage of this system. However, the current design requires a complete regeneration of the timetable when substantial changes arise. Implementing a more flexible approach that allows for partial updates might enhance efficiency and reduce the total need for recalculations.

5. **Reduced Administrative Workload**

   Result: Automating the timetable generation process significantly decreased administrative workload. Tasks that traditionally consumed hours or even days could now be performed in just minutes.

Discussion: The reduction in administrative effort is one of the key benefits of this system. However, input from administrative staff is still necessary to establish constraints such as faculty availability or room assignments. Future improvements through integration with existing academic management systems could further minimize the need for human intervention.

6. **Improved Scheduling Efficiency**

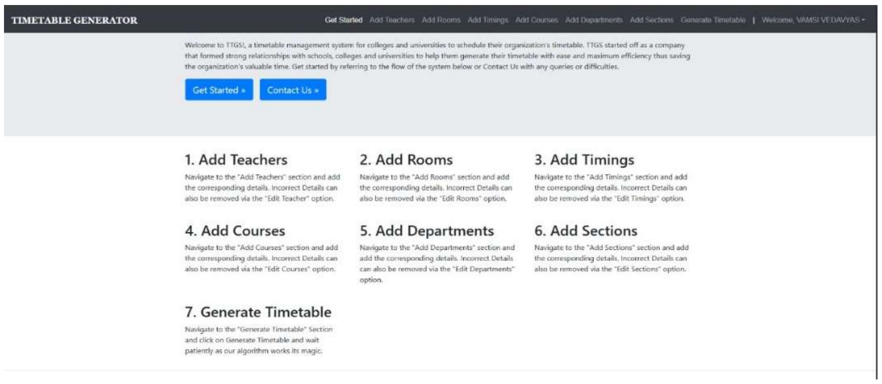
   Result: The time required to generate a complete timetable was drastically reduced. What used to take several days for the administrative team was completed in under a few hours with the automated system.

   Discussion: Enhanced scheduling speed is particularly important for summer terms, which have tighter deadlines. The increased efficiency enabled administrators to dedicate more time to decision-making and less to operational tasks. The system could still be enhanced by further optimizing its performance, especially when dealing with larger datasets and more intricate constraints.

7. **User-Friendly Interface**

   Result: The interface created for the system was intuitive and user-friendly. Administrators found it easy to input required information, view the generated timetable, and make adjustments without needing technical expertise.

   Discussion: The user-friendly design of the system is one of its most significant advantages. It facilitated a smooth transition from a manual to an automated process for all users. Feedback from test users indicated they could navigate the interface with minimal training. Nonetheless, user feedback highlights the need for improvement, especially in providing clearer error messages and offering more customization options for advanced users.



Welcome to TTGS!, a timetable management system for colleges and universities to schedule their organization's timetable. TTGS started off as a company that formed strong relationships with schools, colleges and universities to help them generate their timetable with ease and maximum efficiency thus saving the organization's valuable time. Get started by referring to the flow of the system below or Contact Us with any queries or difficulties.

1. Add Teachers
Navigate to the "Add Teachers" section and add the corresponding details. Incorrect Details can also be removed via the "Edit Teacher" option.

2. Add Rooms
Navigate to the "Add Rooms" section and add the corresponding details. Incorrect Details can also be removed via the "Edit Rooms" option.

3. Add Timings
Navigate to the "Add Timings" section and add the corresponding details. Incorrect Details can also be removed via the "Edit Timings" option.

4. Add Courses
Navigate to the "Add Courses" section and add the corresponding details. Incorrect Details can also be removed via the "Edit Courses" option.

5. Add Departments
Navigate to the "Add Departments" section and add the corresponding details. Incorrect Details can also be removed via the "Edit Departments" option.

6. Add Sections
Navigate to the "Add Sections" section and add the corresponding details. Incorrect Details can also be removed via the "Edit Sections" option.

7. Generate Timetable
Navigate to the "Generate Timetable" Section and click on Generate Timetable and wait patiently as our algorithm works its magic.

Figure 9.2:User Friendly Interface

9.2 PERFORMANCE EVALUATION

Result: The evaluation of summer term timetable generation using a Genetic Algorithm (GA) assesses both the viability and quality of the generated solutions. A key performance metric is the accuracy rate, which indicates the percentage of timetables that meet all strict constraints. This rate is calculated by dividing the number of feasible solutions by the total number of created timetables and then multiplying by 100. For instance, if 95 out of 100 timetables are valid, the accuracy rate stands at 95%. This GA systems for timetable creation as achieved accuracy rates from 90% to 98%.

Besides accuracy, the fitness score evaluates the overall quality of a timetable, imposing penalties for any constraint breaches—lower scores denote more desirable solutions. An effective system aims for complete compliance with hard constraints, while it may only partially meet soft constraints such as preferences from instructors or balanced class distributions, depending on their significance and complexity.

Discussion: Performance is also measured through metrics related to resource use, including the efficiency of room and instructor assignments, as well as the average convergence time, which indicates how many generations or how much time it takes to discover an acceptable solution. In a standard case, a GA-based summer timetable system could realize a 96% accuracy rate, an average fitness score of 8.5, full adherence to hard constraints, and an 82% fulfillment of soft preferences, all within 50 generations or about 20 seconds. These results illustrate the GA's capability to efficiently generate high-quality, conflict-free timetables, even in the restricted and demanding context of a summer academic term.

9.3 DOCUMENTATION AND REPORTING

Result: Thorough documentation and a conclusive report were effectively generated, encompassing detailed explanations of the system's architecture, the algorithms employed, test outcomes, and suggestions for future enhancements.

Discussion: The documentation will act as a valuable resource for anyone interested in modifying or expanding the system down the line. It facilitates comprehension of various constraints and illustrates how the system manages them. Future revisions might emphasize bolstering the documentation with extensive case studies or examples from the testing phase.

9.4 FUTURE WORK AND IMPROVEMENTS

Result: The project has paved the way for numerous future enhancements. Significant areas for continued work include improving the system's adaptability, integrating it with other academic frameworks, and employing machine learning techniques to refine scheduling predictions.

Discussion: As the system evolves, the inclusion of adaptive algorithms capable of dynamically responding to unexpected changes and more complex user preferences would be advantageous. The potential integration of machine learning for pattern identification and decision-making based on historical scheduling data could also significantly boost the system's efficiency.

CHAPTER-10
CONCLUSION

The creation and implementation of the Summer Term Timetable Generation system have successfully tackled the difficulties related to scheduling within shortened academic terms. Utilizing automated methods based on Genetic Algorithms, this system has notably decreased the time and manual labor needed to generate conflict-free, resource-optimized timetables. Essential scheduling elements—such as faculty availability, room sizes, and various course lengths—have been included to guarantee effective resource allocation and prevent overlaps. A key accomplishment of this project is the full automation of timetable creation, which not only lightens the administrative burden but also enhances accuracy and operational efficiency compared to conventional manual scheduling. Additionally, the system is highly adaptable to last-minute alterations, enabling rapid schedule regeneration, which greatly boosts its practical usefulness.

Beyond its strong functionality, the system offers an intuitive interface designed for easy use by administrative personnel who may have limited technical skills—an essential aspect for real-world application. Its modular and scalable design allows for future growth, including integration with larger academic management systems and the capability to handle increasingly complex scheduling situations. While the system has successfully realized its initial objectives, there are encouraging opportunities for further enhancement. Future updates could aim to accommodate more sophisticated constraints, facilitate partial real-time changes, and improve scalability for larger sets of data. Furthermore, incorporating machine learning methods and adaptive algorithms could assist in predicting scheduling conflicts ahead of time and refine decision-making processes, thereby boosting the overall efficiency and intelligence of the system.

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APPENDIX-A

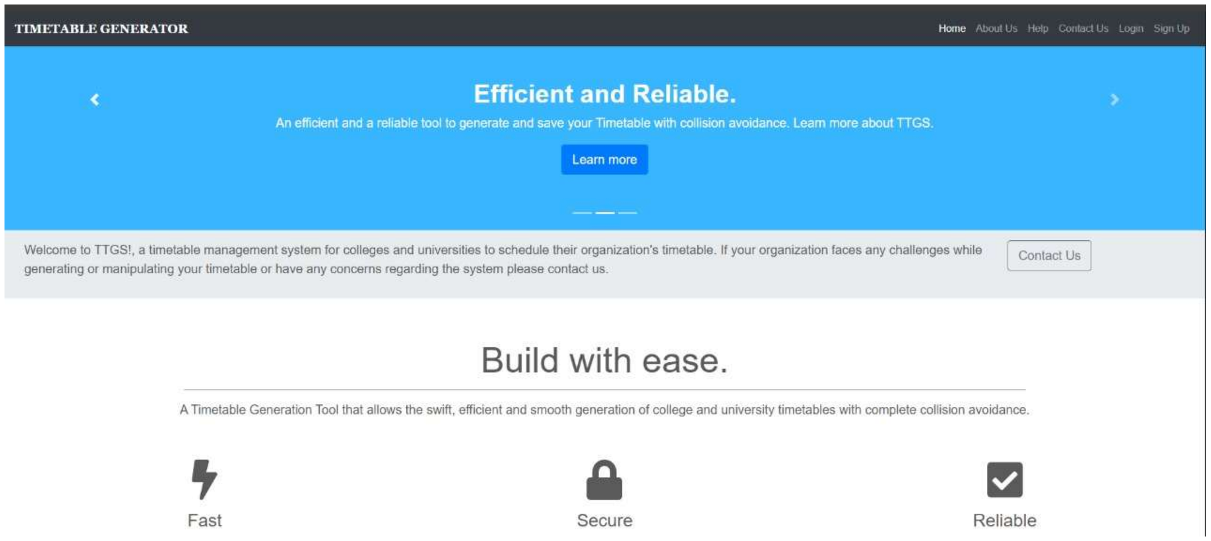
PSUEDOCODE

```
Start
// Navigation to Home1
    Display options: About Us, Help, Contact Us, Login
    If User selects "About Us":
        Display system details and its purpose
    If User selects "Help":
        Display help page or FAQs
    If User selects "Contact Us":
        Display contact details for technical support
    If User selects "Login":
        Navigate to Login Page
// Login Process
    Accept username and password
    Verify credentials with database
    If valid:
        Redirect to Home2
    Else:
        Display "Invalid credentials"
// Registration Process
    Accept registration details (name, email, password, etc.)
    Insert registration details into the database
    Display "Registration successful"
// Navigate to Home2 (Post Login)
    Display options: Add Teacher, Add Rooms, Add Timings, Add Courses, Add
Department, Add Sections, Generate Timetable
    If User selects "Add Teacher":
        Accept teacher details (ID, name, department, etc.)
        Validate details
        Insert teacher details into database
    If User selects "Add Rooms":
        Accept room details (room ID, name, capacity, etc.)
        Validate details
        Insert room details into database
    If User selects "Add Timings":
        Accept timing details (start time, end time, session type, etc.)
        Validate details
        Insert timing details into database
    If User selects "Add Courses":
        Accept course details (course ID, name, semester, etc.)
        Validate details
        Insert course details into database

If User selects "Add Department":
        Accept department details (department ID, name, head of department, etc.)
        Validate details
        Insert department details into database
    If User selects "Add Sections":
        Accept section details (section ID, course ID, etc.)
        Validate details
        Insert section details into database


    If User selects "Generate Timetable":
        Fetch teacher, room, course, and timing details from the database
        Generate timetable based on availability and constraints
// Logout Process
  If User selects "Logout":
    End session and return to Home1
    End
```

APPENDIX-B

SCREENSHOTS

OUTPUTS:



Efficient and Reliable.

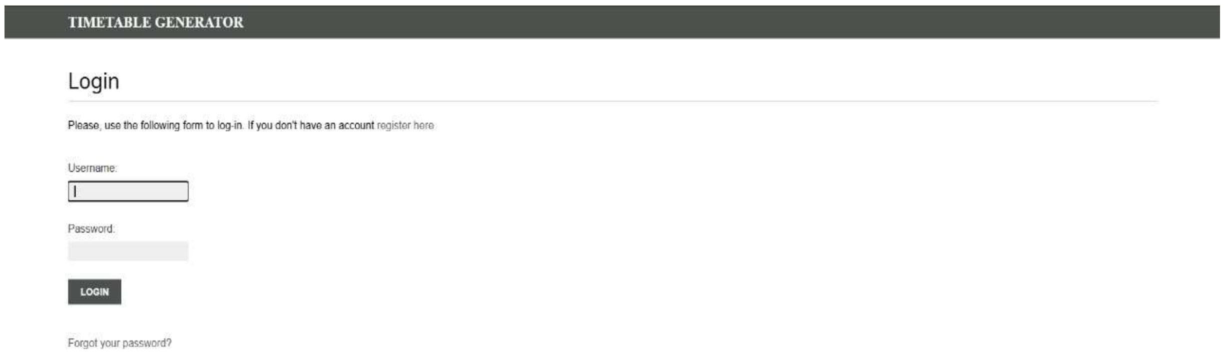
An efficient and a reliable tool to generate and save your Timetable with collision avoidance. Learn more about TTGS.

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.

Figure 11.1:Home page



Please, use the following form to log-in. If you don't have an account register here

Figure 11.2 : Log In Page

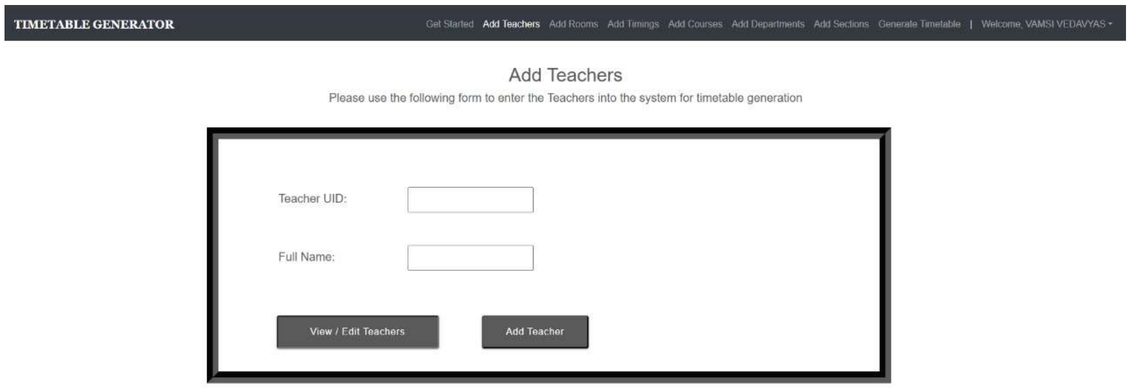


Figure 11.3: Add Teachers

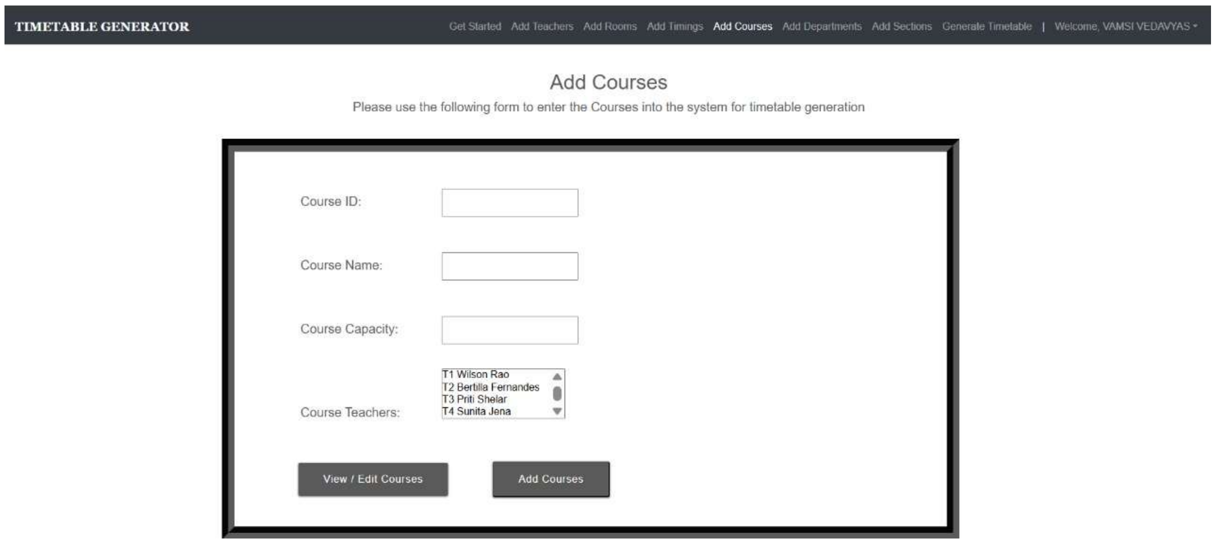
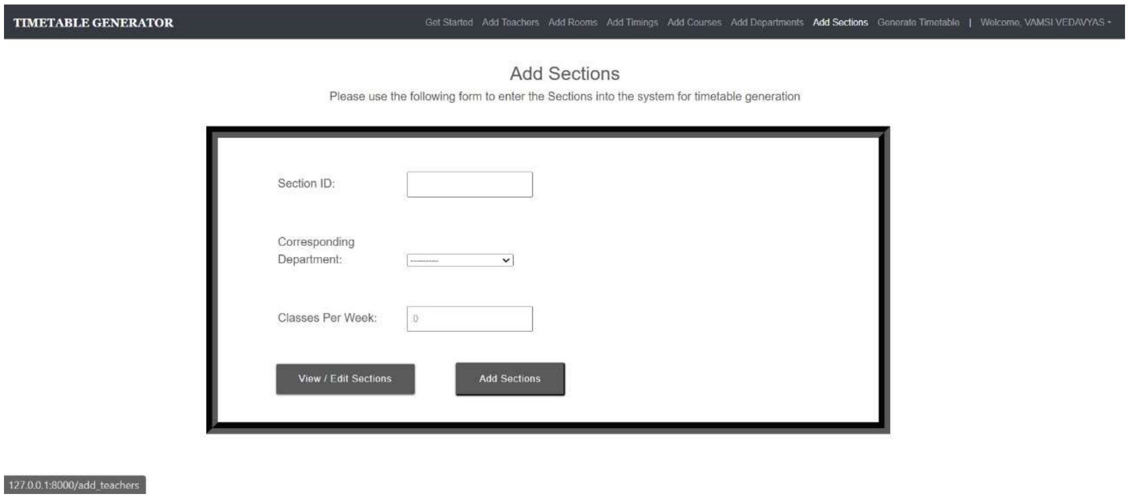


Figure 11.4: Add Courses

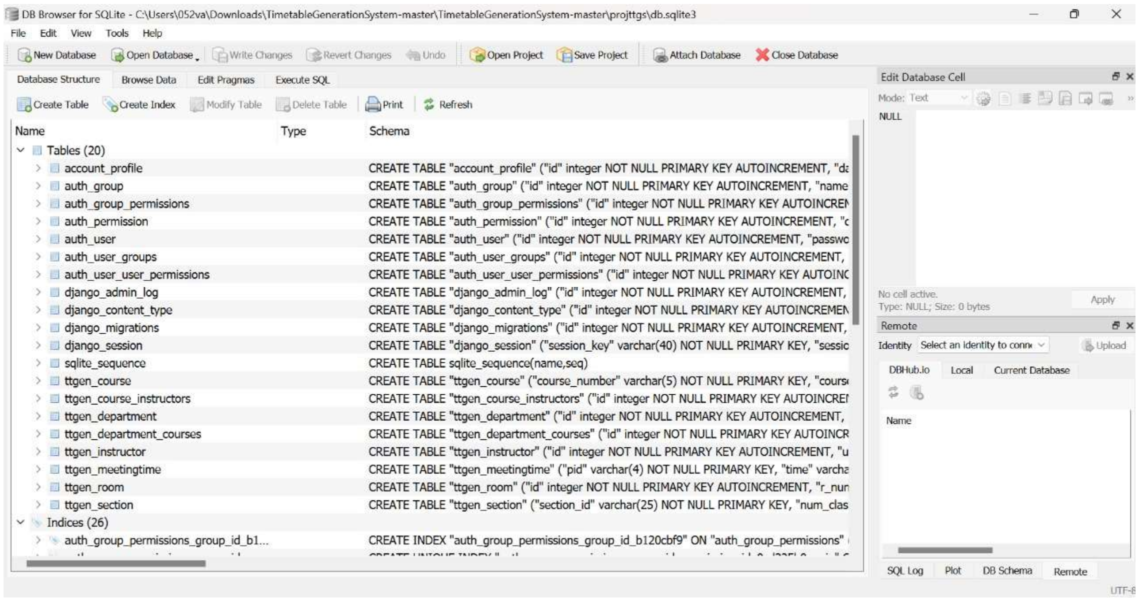


Add Sections

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

Section ID:	
Corresponding Department:	---------
Classes Per Week:	0

Figure 11.5 :Add sections



DB Browser for SQLite - C:\Users\052va\Downloads\TimetableGenerationSystem-master\TimetableGenerationSystem-master\projttgs\db.sqlite3

Name	Type	Schema
Tables (20)		
account_profile		CREATE TABLE "account_profile" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMENT, "da
auth_group		CREATE TABLE "auth_group" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMENT, "name
auth_group_permissions		CREATE TABLE "auth_group_permissions" ("id" integer NOT NULL PRIMARY KEY AUTOINCREI
auth_permission		CREATE TABLE "auth_permission" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMENT, "c
auth_user		CREATE TABLE "auth_user" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMENT, "passwo
auth_user_groups		CREATE TABLE "auth_user_groups" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMENT,
auth_user_user_permissions		CREATE TABLE "auth_user_user_permissions" ("id" integer NOT NULL PRIMARY KEY AUTOINC
django_admin_log		CREATE TABLE "django_admin_log" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMENT,
django_content_type		CREATE TABLE "django_content_type" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMEN
django_migrations		CREATE TABLE "django_migrations" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMENT,
django_session		CREATE TABLE "django_session" ("session_key" varchar(40) NOT NULL PRIMARY KEY, "sessic
sqlite_sequence		CREATE TABLE sqlite_sequence(name,seq)
ttgen_course		CREATE TABLE "ttgen_course" ("course_number" varchar(5) NOT NULL PRIMARY KEY, "cours
ttgen_course_instructors		CREATE TABLE "ttgen_course_instructors" ("id" integer NOT NULL PRIMARY KEY AUTOINCREI
ttgen_department		CREATE TABLE "ttgen_department" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMENT,
ttgen_department_courses		CREATE TABLE "ttgen_department_courses" ("id" integer NOT NULL PRIMARY KEY AUTOINCR
ttgen_instructor		CREATE TABLE "ttgen_instructor" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMENT, "u
ttgen_meetingtime		CREATE TABLE "ttgen_meetingtime" ("pid" varchar(4) NOT NULL PRIMARY KEY, "time" varcha
ttgen_room		CREATE TABLE "ttgen_room" ("id" integer NOT NULL PRIMARY KEY AUTOINCREMENT, "r_nun
ttgen_section		CREATE TABLE "ttgen_section" ("section_id" varchar(25) NOT NULL PRIMARY KEY, "num_clas
Indices (26)		
auth_group_permissions_group_id_b1...		CREATE INDEX "auth_group_permissions_group_id_b120cbf9" ON "auth_group_permissions"

Mode: Text

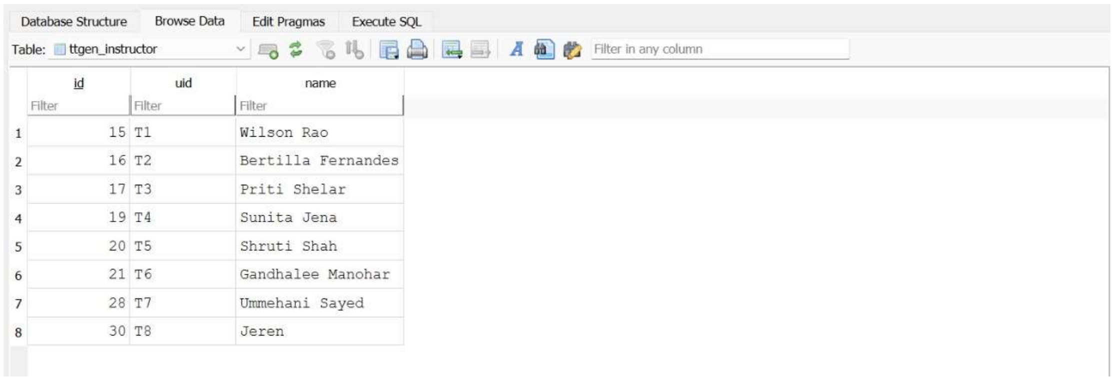
NULL

No cell active.
Type: NULL; Size: 0 bytes

Identity Select an identity to conn

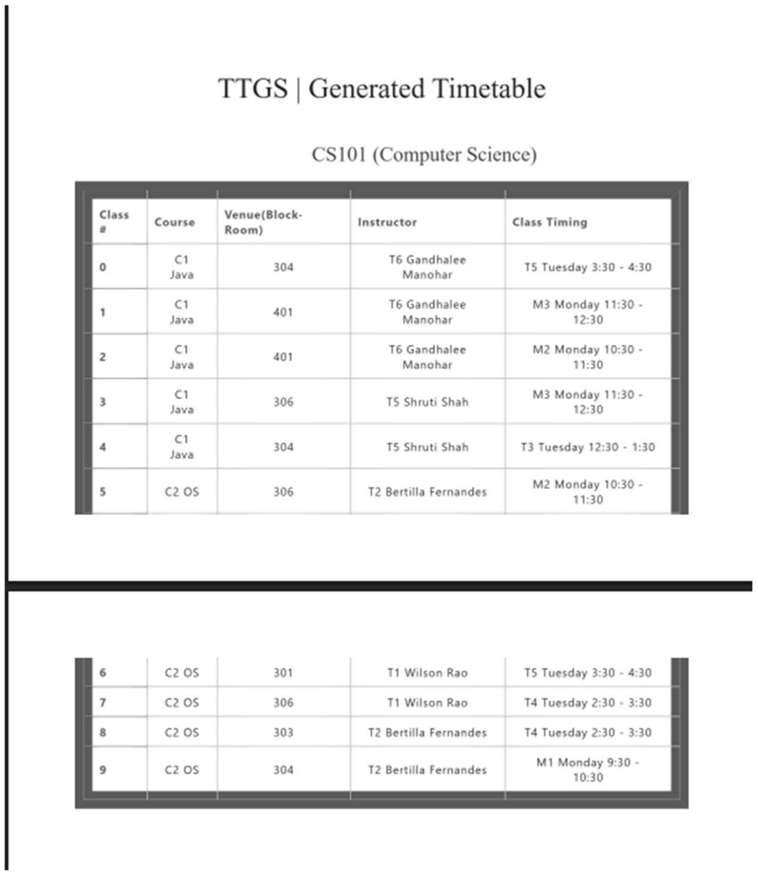
Name

Figure 11.6 : Database SqLite3



	id	uid	name
1	15	T1	Wilson Rao
2	16	T2	Bertilla Fernandes
3	17	T3	Priti Shelar
4	19	T4	Sunita Jena
5	20	T5	Shruti Shah
6	21	T6	Gandhalee Manohar
7	28	T7	Ummehani Sayed
8	30	T8	Jeren

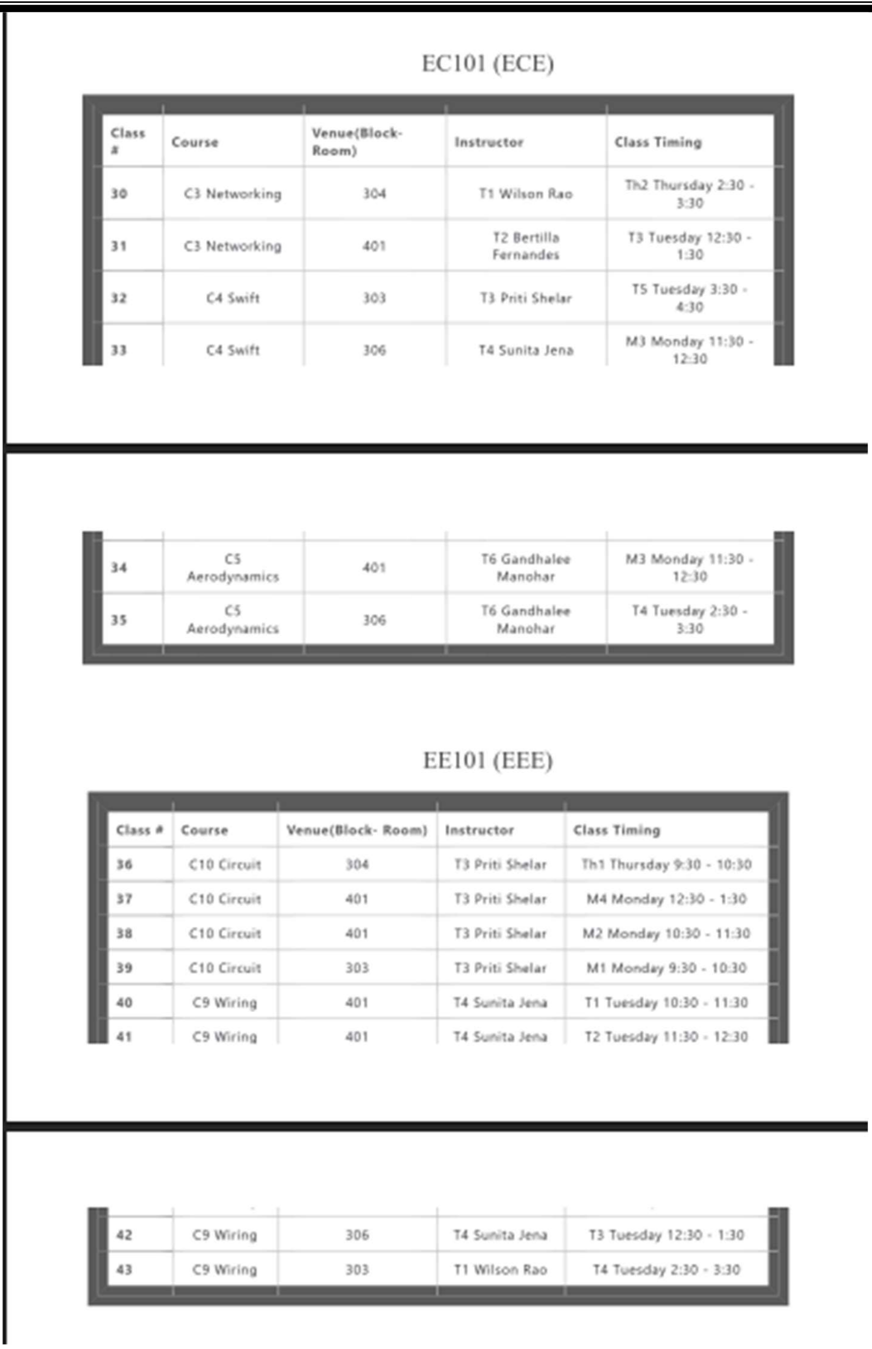
Figure 11.7: Updated Database



TTGS | Generated Timetable

CS101 (Computer Science)

Class #	Course	Venue(Block-Room)	Instructor	Class Timing
0	C1 Java	304	T6 Gandhalee Manohar	T5 Tuesday 3:30 - 4:30
1	C1 Java	401	T6 Gandhalee Manohar	M3 Monday 11:30 - 12:30
2	C1 Java	401	T6 Gandhalee Manohar	M2 Monday 10:30 - 11:30
3	C1 Java	306	T5 Shruti Shah	M3 Monday 11:30 - 12:30
4	C1 Java	304	T5 Shruti Shah	T3 Tuesday 12:30 - 1:30
5	C2 OS	306	T2 Bertilla Fernandes	M2 Monday 10:30 - 11:30
6	C2 OS	301	T1 Wilson Rao	T5 Tuesday 3:30 - 4:30
7	C2 OS	306	T1 Wilson Rao	T4 Tuesday 2:30 - 3:30
8	C2 OS	303	T2 Bertilla Fernandes	T4 Tuesday 2:30 - 3:30
9	C2 OS	304	T2 Bertilla Fernandes	M1 Monday 9:30 - 10:30



EC101 (ECE)

Class #	Course	Venue(Block- Room)	Instructor	Class Timing
30	C3 Networking	304	T1 Wilson Rao	Th2 Thursday 2:30 - 3:30
31	C3 Networking	401	T2 Bertilla Fernandes	T3 Tuesday 12:30 - 1:30
32	C4 Swift	303	T3 Priti Shelar	T5 Tuesday 3:30 - 4:30
33	C4 Swift	306	T4 Sunita Jena	M3 Monday 11:30 - 12:30
34	C5 Aerodynamics	401	T6 Gandhalee Manohar	M3 Monday 11:30 - 12:30
35	C5 Aerodynamics	306	T6 Gandhalee Manohar	T4 Tuesday 2:30 - 3:30

EE101 (EEE)

Class #	Course	Venue(Block- Room)	Instructor	Class Timing
36	C10 Circuit	304	T3 Priti Shelar	Th1 Thursday 9:30 - 10:30
37	C10 Circuit	401	T3 Priti Shelar	M4 Monday 12:30 - 1:30
38	C10 Circuit	401	T3 Priti Shelar	M2 Monday 10:30 - 11:30
39	C10 Circuit	303	T3 Priti Shelar	M1 Monday 9:30 - 10:30
40	C9 Wiring	401	T4 Sunita Jena	T1 Tuesday 10:30 - 11:30
41	C9 Wiring	401	T4 Sunita Jena	T2 Tuesday 11:30 - 12:30
42	C9 Wiring	306	T4 Sunita Jena	T3 Tuesday 12:30 - 1:30
43	C9 Wiring	303	T1 Wilson Rao	T4 Tuesday 2:30 - 3:30

Figure 11.8: TTGS

APPENDIX-C

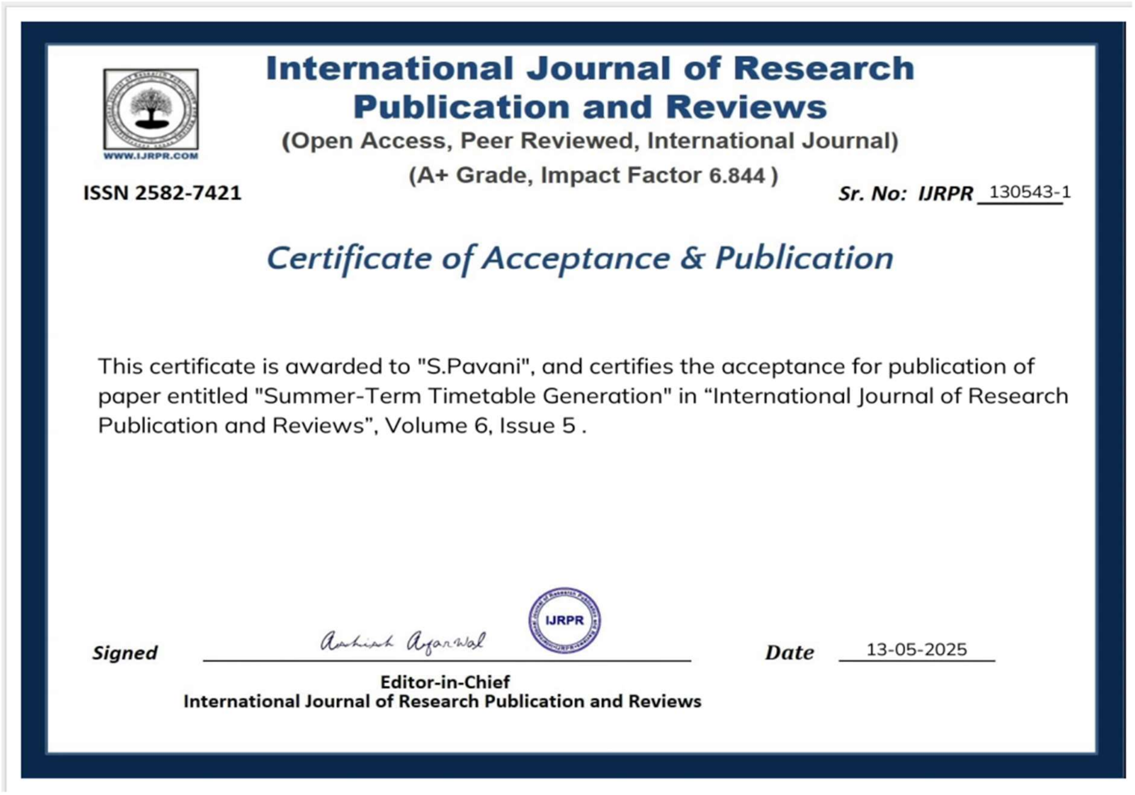
ENCLOSURES

1. Journal publication/Conference Paper Presented Certificates (if any).

2. Include certificate(s) of any Achievement/Award won in any project-related event.

3. Similarity Index / Plagiarism Check report clearly showing the Percentage (%). No need for a page-wise explanation.

4. Details of mapping the project with the Sustainable Development Goals (SDGs).



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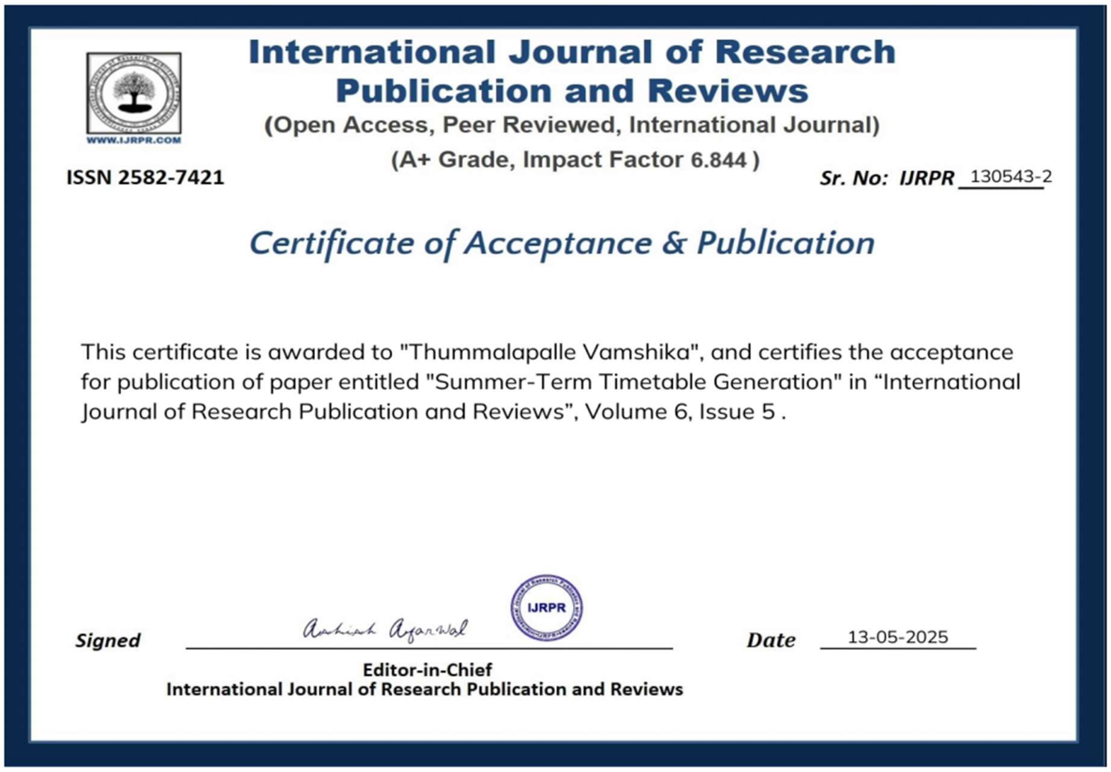

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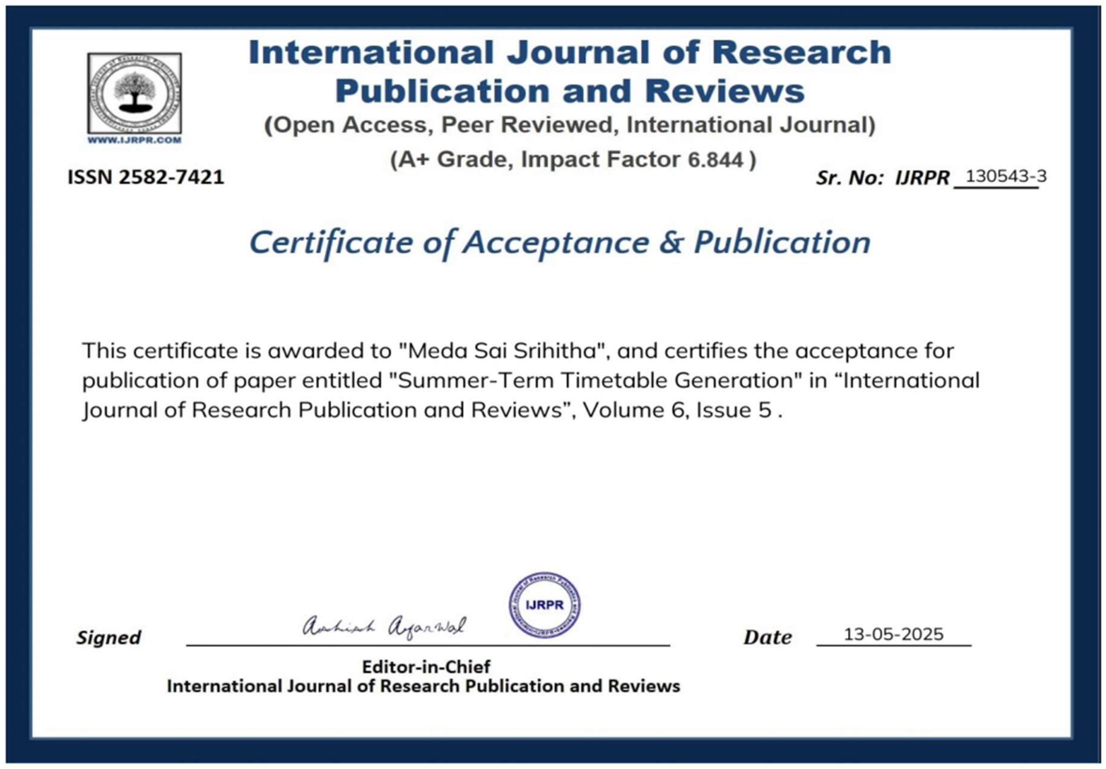

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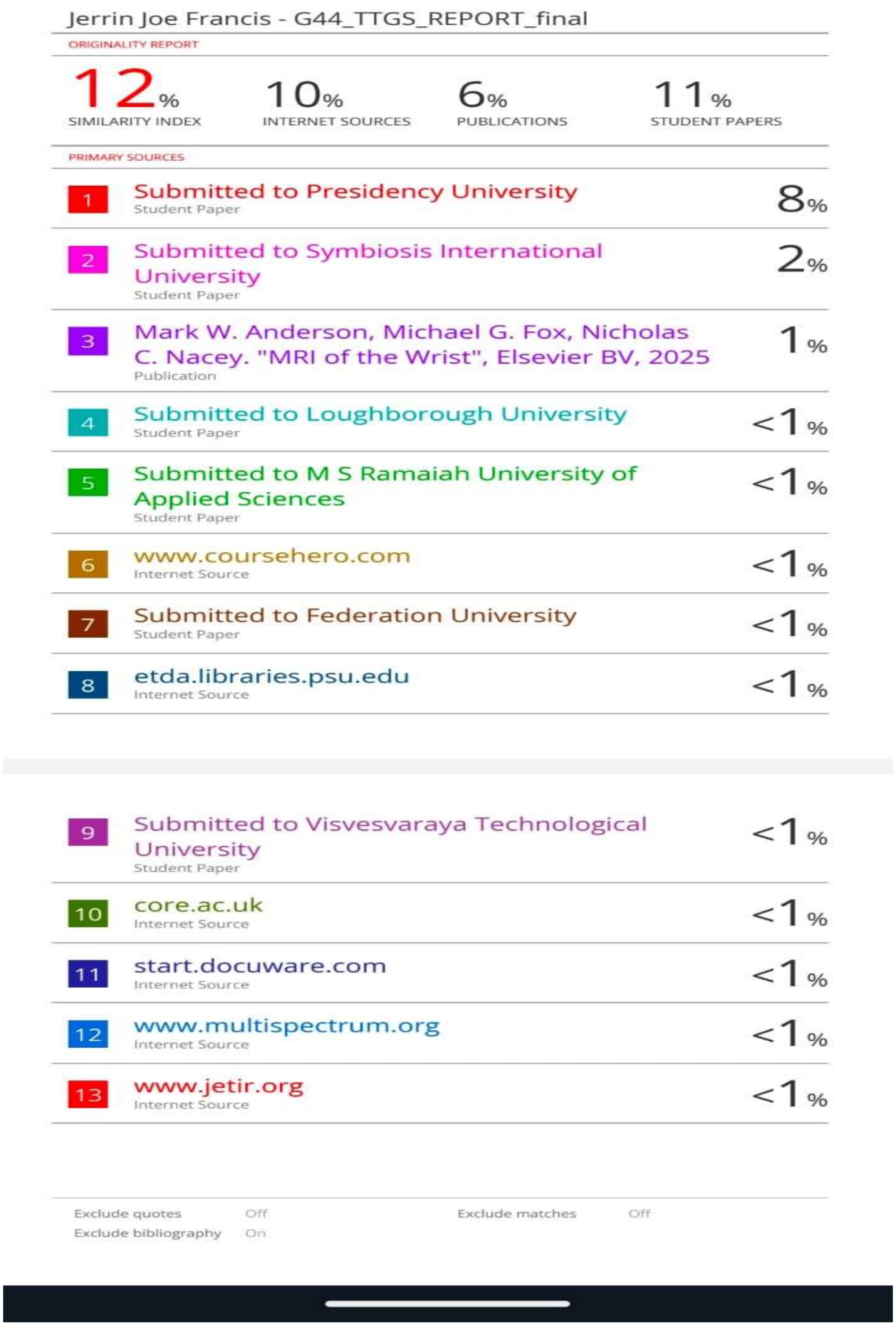

Jerrin Joe Francis - G44_TTGS_REPORT_final

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SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

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2	Submitted to Symbiosis International University Student Paper	2%
3	Mark W. Anderson, Michael G. Fox, Nicholas C. Nacey. "MRI of the Wrist", Elsevier BV, 2025 Publication	1%
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SUSTAINABLE DEVELOPMENT GOALS

SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

Figure 12:SDG

SDG Goal	**Connection to Timetable Management System**	**Impact**
1.Quality Education	Efficiently organizes academic schedules, reducing conflicts and optimizing resource allocation for students and teachers.	Improves access to structured and equitable education for all learners.

Table 12: SDG Goals