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A Survey on Schedule Academic Time Table Using AI and ML

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A B S T R A C T

This survey paper investigates the fusion of Genetic Algorithms (GAs) and Data Structures and Algorithms (DSAs) to establish a robust Academic Timetable Scheduler empowered by Artificial Intelligence (AI) and Machine Learning (ML) methodologies. The objective of this study is to offer a comprehensive insight into the approaches and tools applied to alleviate the intricacies associated with academic timetable generation. The paper initiates by elucidating the foundational concepts of academic timetable planning and delineating the complexities and constraints inherent in the process. The integration of GAs is explained, emphasizing their ability to enhance the scheduling process through evolutionary principles. A central focus of this survey is the utilization of DSAs to efficiently store and manage academic data. The subsequent section features case studies and real-world applications, illustrating the successful utilization of AI and ML techniques across diverse academic settings. Our main focus in creating this survey is about the time consumed by the Timetable scheduler for returning the output as required, we are going to ensure that the time taken by the timetable scheduler should be less. Additionally, the paper emphasizes the crucial role of JavaScript and other web-based frameworks in delivering user-friendly interfaces and optimal timetable solutions.

Keywords: Academic timetable scheduling, user-friendly interfaces, evolutionary principles, constraints, Real-world applications.

1. INTRODUCTION

In the ever-evolving landscape of educational institutions, effective timetable scheduling remains an enduring hurdle. Acknowledging the pressing demand for inventive solutions, this article introduces a pioneering implementation of Genetic Algorithms to address the intricate Timetable Scheduling Problem. Unlike conventional approaches, our strategy not only seeks to minimize conflicts but also strives to introduce a new era of automated timetable scheduling.

Introducing Genetic Algorithms: Genetic Algorithms, the cornerstone of our revolutionary approach, leverage the principles of natural selection to optimize intricate problems. Within this context, we delve into the essence of Genetic Algorithms, illuminating their inner workings and demonstrating their flexibility in resolving complex scheduling challenges.

Challenges in Timetable Management: Educational institutions wrestle with the complexities of timetable management, navigating a myriad of conflicts and constraints. Our objective is to dissect the current issues affecting timetable management, clearing the path for an innovative paradigm shift.

Project Objectives: Unveiling Genetic Algorithms: Uncover the mysteries surrounding Genetic Algorithms, offering a comprehensive insight into their mechanisms and applicability.

Challenges in Timetable Management: Investigate the existing hurdles in timetable management, underscoring the necessity for a transformative approach to scheduling.

Prototype for Automated Timetable Scheduling: Display the capabilities of Genetic Algorithms through the development of a prototype for an automated timetable scheduling system. This signifies a departure from traditional methods, presenting a fresh solution to longstanding problems.

2. LITERATURE SURVEY

[1] P. Uma: Assistant Professor, Computer Science and Engineering, Nanda Engineering College, Erode. P. S. Sharvesh: Student, Computer Science and Engineering, Nanda Engineering College, Erode. M. Pradeep: Student, Computer Science and Engineering, Nanda Engineering College, Erode.

P. Sathishkumar: Student, Computer Science and Engineering, Nanda Engineering College, Erode. R. Senthilnathan: Student, Computer Science and Engineering, Nanda Engineering College, Erode. Automation significantly reduces the time and effort required to create schedules, improving the overall

efficiency of the scheduling process. The use of multiple algorithms allows for optimization and the generation of high-quality timetables that adhere to various constraints and objectives. The project aims to efficiently utilize all available resources, which is essential for educational institutions.

Implementing multiple algorithms for timetable generation can be complex and resource-intensive, requiring careful design, integration, and evaluation. The success of the system may depend on how well it aligns with the needs and preferences of the educational institution's faculty and administration. Develop an intuitive and user-friendly interface that allows users to input scheduling constraints and preferences easily. Implement a system that allows real-time changes and rescheduling based on evolving constraints, faculty availability, and student preferences. Prioritize data security and privacy, especially when handling sensitive academic and student information. Integrate a feedback mechanism for users to report issues, suggest improvements, and provide input on scheduling preferences.[1]

[2] Mr. M. K. Mohamed Faizal: Assistant Professor, M.I.E.T. Engineering College Trichy, India. Vanmathi Karunanithi: Computer Science and Engineering, M.I.E.T. Engineering College Trichy India. Thamarai Selvi Balu: Computer Science and Engineering, M.I.E.T. Engineering College Trichy India. Nithya Senthilkumar: Computer Science and Engineering, M.I.E.T. Engineering College Trichy India. The project mentions using a data category algorithm to categorize department-wise time scheduling, which can help optimize class timings based on specific requirements and constraints. By preventing overlapping schedules and making the best use of faculty subject demands, the system can help optimize resource utilization within the institution. An automated timetable generation system can significantly reduce the time and effort required to create schedules, improving the efficiency of the scheduling process. The project scalability to accommodate scheduling challenges in larger institutions may not be clear. The effectiveness of the solution may vary based on the size and complexity of the college. Implementing an effective automated timetable generation system can be complex, particularly when dealing with a wide range of scheduling constraints and preferences. Develop an intuitive user interface that allows for easy input of scheduling constraints and preferences. This can enhance the accessibility and user-friendliness of the system. Integrate feedback mechanisms for users to report issues, suggest improvements, and provide input on scheduling preferences. Prioritize data security and privacy, especially when dealing with sensitive academic and student information.[2]

[3] Prof. Jyothi Patil1, Shambhavi V2, Sneha N T3, Sweta Jadhav4, Tahura Sadaf5 Department of Electronics & Communication Engineering, P D A College of Engineering, Kalaburagi, Karnataka, India. The goal of this project is to create a timetable generator for colleges. The creation of schedules is a very common issue that affects all educational institutions. The conflict between staff members' preferences is precisely where the issue arises. Every semester, colleges are required to create timetables, which used to be an extremely time-consuming task. Once the timetables are set for a given semester, the student is allowed to access them. Once the timetables are established for a particular semester, employees are also permitted to check the class allotment schedule. The Time Table Assignment for Any Department project's goal was to create an application that would allow staff and student allotment subject to classes. The following information was added by the administrator for Adding the student, the staff, and the subject, enter the timetable, and update the timetable. The majority of colleges offer a variety of programmes, each of which has several disciplines. There are now a limited number of faculties, each of which teaches many disciplines. Therefore, the timetable now has to include the instructors at the appropriate times. the timetable schedule, which makes the most use of all faculty subject demands, and slots so that their timings do not cross. For this, a genetic algorithm is employed. We suggest using a timetable object in our method for creating timetables. This object consists of classroom objects, their respective schedules, and a fitness rating for the schedule. Additionally, to further describe the imperatives, we used a composite configuration design that is easily expandable to include or uproot as many duties. Every obligation class now checks the condition found in our investigation between two timetable objects. In the unlikely event that the requirement is met, the score is raised by one if a crash is available.[3]

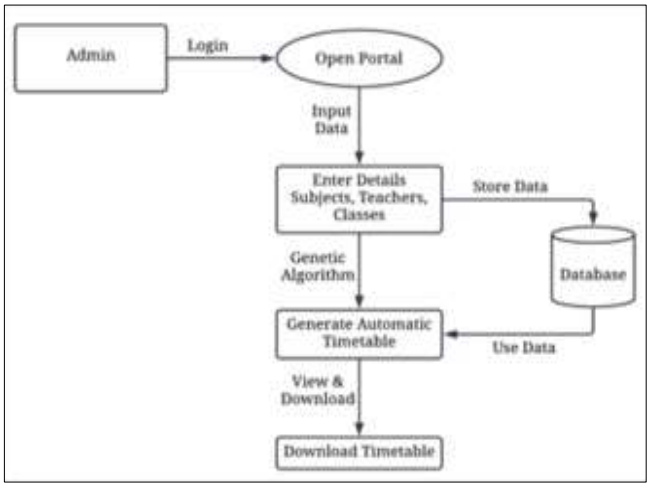
[4] Authored by Tiny Wijerathna Ekanayake, Pavani Subasinghe, Shawn Ragel, Anjalie Gamage, and Suchini Attanayaka from the Faculty of Computing at Sri Lanka Institute of Information Technology, Malabe, Sri Lanka. This project explicitly delves into the domain of two distinct timetables: examination and semester timetables, acknowledging the inherent differences in constraints and requirements associated with each type. Timetable scheduling presents a concrete real-world challenge in educational institutions, with potential solutions directly impacting efficiency and resource allocation. The intricate process of implementing and comparing multiple scheduling algorithms necessitates a thoughtful blend of careful design and meticulous evaluation. The effectiveness of these algorithms depends on the specific rules, constraints, and requirements unique to different educational institutions, making a universally applicable solution challenging to attain.

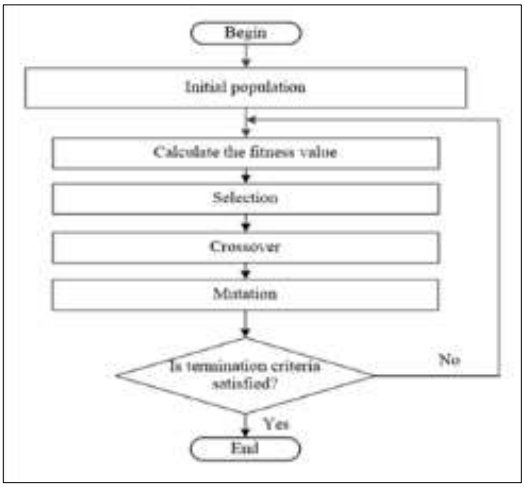
Recognizing the absence of a one-size-fits-all solution, the project emphasizes the importance of developing an intuitive user interface. This interface serves as an entry point for educational institutions to easily input their specific constraints and preferences. Furthermore, the algorithms employed should demonstrate scalability, capable of addressing scheduling challenges for educational institutions varying in size and complexity. Essentially, the Intelligent Timetable Scheduler represents a comprehensive exploration into diverse algorithms, aiming to pave the way for customized solutions in the domain of educational timetable management.[4]

[5] Ernesto Cortés Pérez: Ingeniería en Computacion, Universidad del Istmo, UNISTMO, Sto. Domingo Tehuantepec, Oaxaca, México. Osiris Montero Rios: Ingeniería en Computacion, Universidad del Istmo, UNISTMO, Sto. Domingo Tehuantepec, Oaxaca, México. Daniel Pacheco Bautista: Ingeniería en Computacion, Universidad del Istmo, UNISTMO, Sto. Domingo Tehuantepec, Oaxaca, México. Sergio Sanchez Sanchez: Ingeniería en Computacion, Universidad del Istmo, UNISTMO, Sto. Domingo Tehuantepec, Oaxaca, México. Francisco Aguilar Acevedo: Ingeniería en Computacion, Universidad del Istmo, UNISTMO, Sto. Domingo Tehuantepec, Oaxaca, México. Using a Genetic Algorithm can significantly reduce the time and effort required to create university timetables, particularly when dealing with many professors, subjects, and constraints. Genetic Algorithms have the potential to find high-quality schedules that meet various constraints and objectives, contributing to better resource allocation and utilization. The project addresses a real-world problem that many educational institutions face, making it directly relevant and impactful. The solution may not be directly applicable to other educational institutions as scheduling constraints and requirements can vary significantly. Implementing a Genetic Algorithm for timetable scheduling requires computational resources and expertise in algorithm design and optimization. Implementing a Genetic Algorithm for timetable scheduling requires computational resources and expertise in algorithm design and optimization. Integrate a feedback mechanism for users to report issues and suggest

improvements, helping in ongoing refinement of the scheduling algorithms. Prioritize data security and privacy, especially when dealing with sensitive academic and student information.[5]

3. PROPOSED METHODOLOGY





Explanatory Description:

Module 01: Training Dataset with faces

1. **Module Purpose:**
    - The primary purpose of Module 01 is to compile and create a comprehensive training dataset consisting of facial images. This dataset will serve as the foundation for training the Face Recognition algorithms used in the Academic Timetable Planner.
2. **Data Collection:**
    - The module begins with the collection of facial images from various sources, including students, faculty, and staff. These images should be representative of the individuals who will be using the attendance tracking system.
3. **Data Quality Assurance:**
    - Data quality is a critical aspect. Ensure that the collected images are of high quality and represent the diversity of appearances, including variations in lighting, poses, and expressions.
4. **Data Annotation:**
    - Each image in the dataset needs to be annotated with relevant metadata, such as the names or unique identifiers of the individuals in the images. This step is essential for training the recognition algorithms.
5. **Data Augmentation (Optional):**
    - If necessary, perform data augmentation techniques to increase the size and diversity of the training dataset. These techniques may involve adding noise, cropping, or rotating images to simulate real-world conditions.
6. **Privacy and Security:**
    - Pay close attention to data privacy and security. Ensure that individuals in the dataset have given their consent for the use of their facial images, and implement measures to protect the data from unauthorized access.
7. **Balanced Representation:**
    - Strive for a balanced representation of different individuals in the dataset. Imbalanced datasets can lead to biased recognition results.
8. **Dataset Management:**
    - Create a structured and well-documented dataset management system to keep track of the images, annotations, and any updates or additions to the dataset.
9. **Regular Updates:**

- Recognize that the dataset may need periodic updates to include new individuals or adapt to changing demographics within the educational institution.

10. **Compatibility with Recognition Algorithms:**
    - Ensure that the training dataset is compatible with the Face Recognition algorithms selected in earlier phases. This may involve format conversions and preprocessing.
11. **Backup and Redundancy:**
    - Implement data backup and redundancy measures to prevent data loss and ensure the dataset's availability throughout the project's lifecycle.
12. **Ethical Considerations:**
    - Adhere to ethical guidelines and consent requirements when handling facial data. Protect the privacy and rights of individuals in the dataset.

Module 02: Real-time Scheduling and Data Utilization

1. **Real-Time Scheduling Engine:**
    - Implement a real-time scheduling engine capable of dynamically adjusting timetables based on changing circumstances and requirements.
2. **Dynamic Resource Allocation:**
    - Develop algorithms and rules for allocating classrooms, faculty, and other resources in real time to minimize conflicts and optimize resource utilization.
3. **Data Integration:**
    - Ensure seamless integration of academic data, including course schedules, faculty availability, and student preferences, into the real-time scheduling engine.
4. **Live Data Feeds:**
    - Establish mechanisms for live data feeds, allowing the system to receive and process real-time updates on class cancellations, room availability, and faculty substitutions.
5. **Adaptive Decision-Making:**
    - Implement intelligent decision-making processes that consider multiple factors, such as room capacities, faculty expertise, and student enrolment, to make scheduling decisions in real-time.
6. **Conflict Resolution Logic:**
    - Develop algorithms and logic for conflict resolution, enabling the system to address scheduling conflicts as they arise.
7. **User Notifications:**
    - Configured the system to send real-time notifications to educators, students, and administrators regarding schedule changes, cancellations, and updates.
8. **Data Analytics and Insights:**
    - Implement data analytics tools to generate insights from the academic data, helping institutions make data-driven decisions for timetable adjustments.
9. **Feedback Loop:**
    - Create a feedback mechanism for users to report scheduling issues and preferences, allowing the system to continuously adapt and improve.

Requirement Analysis:

Functional Requirements

2. Non – Functional Requirements

1. Functional Requirements:

The following are the functional requirements of the system:

• To implement a user interface on the system

• User-friendly front-end design using Cascading Style Sheets.

• Strong authentication while performing various operations.

• Java script validations and alerts wherever needed.

2. Non-Functional Requirements:

The following are non-functional requirements of the system:

1. Secure access to confidential data (user's details). SSL can be used.

2. Better component design to get better performance at peak time.

3. Flexible service-based architecture will be highly desirable for future extensions.

4. Proposed Algorithm

The whole method of scheduling based on a genetic algorithm is explained in detail in this section.

A scheduling procedure is divided into several important modules as follows,

1. Data encoding and decoding

2. Initial population

3. Evaluation of population

4. Crossover Evolution

5. Mutation

6. New Population

Data Encoding and Decoding:

Data encoding is the initial step in the Genetic Algorithm, transforming a solution into a chromosome represented as a simple value, such as a string. This process enhances algorithm speed, and a common approach is to convert data into a binary string. Genes, constituting parts of chromosomes, can also be converted to binary strings. This type of data conversion facilitates algorithm treatment, with the chromosome string composed of side-by-side gene strings.

Initial Population:

The first step in the Genetic Algorithm involves creating multiple random individuals based on hard constraints. The size of the initial population is determined by user needs. A small population may diminish over generations due to evolution, while a large population yields better results at the cost of increased resources and slower processing. The population is often represented as a set

Evaluation of Population:

The fitness of a solution is evaluated using soft constraints, determining how good the solution is within a valid range. Population evaluation is a crucial aspect of the Genetic Algorithm, employing a fitness function to rank solutions. Fitness is usually expressed on a scale of 0 to 1, where 1 represents the best solution, and 0 represents the worst. This allows for a comparative assessment of solutions within the population.

Crossover Evolution:

Crossover evolution is a method for generating a new population based on the existing one. The simple crossover evolution involves taking two chromosomes and creating a specified number of new chromosomes (X). This process entails splitting the two chromosomes into parts and generating new chromosomes by combining different parts. The goal is to introduce diversity and potentially enhance solution quality.

Mutation:

Mutation is employed to introduce randomness and variability into the algorithm. It involves randomly changing the values of a gene, leading to the creation of new, unexpected solutions. These mutated solutions provide a different perspective for the fitness function. Importantly, mutation only affects the chromosome undergoing the mutation, leaving other solutions unchanged.

New Population:

The combination of crossover and mutation operations results in the creation of a new population comprising original solutions. This new population inherits traits from the previous generation while introducing diversity through genetic recombination and random mutations.potential integration of IoT devices for additional functionality are avenues for improvement, with ongoing compliance with data privacy regulations being essential for ethical and legal standing. Pursuing these developments can make the Real-Time Attendance System a versatile and indispensable tool in educational technology, contributing to efficiency and engagement.

5. Conclusion

In the dynamic realm of academic institutions, the "AI and ML-Powered Academic Timetable Planner" project stands as a testament to the transformative influence of technology on academic administration. Through systematic planning and execution across each project phase, we have ushered in a substantial evolution in the management of academic timetables. The noteworthy achievements of this initiative include:

• Crafting a resilient web portal characterized by a user-centric design, placing a premium on efficiency and user-friendliness.

• Incorporating state-of-the-art Computer Vision technology for real-time classroom scanning, achieving unparalleled precision in attendance tracking.

• Deploying real-time scheduling and dynamic data utilization, ensuring adaptability and optimal resource management in the academic landscape.

This project marks a paradigm shift in how educational institutions approach schedule and attendance management. It introduces a system that not only simplifies the experiences of educators and students but also contributes to an enhanced and efficient academic ecosystem. Academic timetables are transformed from static, inflexible schedules into dynamic, adaptable systems that respond to real-time changes and individual preferences.

References

[1] “Automatic Timetable Generation”

P. Uma: Assistant Professor, Computer Science and Engineering, Nanda Engineering College, Erode. P.

S. Sharvesh: Student, Computer Science and Engineering, Nanda Engineering College, Erode. M.

Pradeep: Student, Computer Science and Engineering, Nanda Engineering College, Erode. P.

Sathishkumar: Student, Computer Science and Engineering, Nanda Engineering College, Erode.

R. Senthilnathan: Student, Computer Science and Engineering, Nanda Engineering College, Erode.

Publisher Name: IJRASET (2023-04-05).

[2] “College Timetable using Time Scheduling Algorithm”

Mr. M. K. Mohamed Faizal: Assistant Professor, M.I.E.T. Engineering College Trichy, India. Vanuatu

Karunanithi: Computer Science and Engineering, M.I.E.T. Engineering College Trichy, India. Thamarai

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Senthilkumar: Computer Science and Engineering, M.I.E.T. Engineering College Trichy India.

Publisher Name: IJERT (30-07-2022).

[3] “Automatic Timetable Generator”

Prof. Jyothi Patil1, Shambhavi V2, Sneha N T3, Sweta Jadhav4, Tahura Sadaf Department of Electronics & Communication Engineering, P D A College of Engineering, Kalaburagi, Karnataka, India.

Publisher Name: IJRASET (2023-06-07).

[4] “Intelligent Timetable Scheduler: A Comparison of Genetic, Graph Coloring, Heuristic and Iterated Local Search Algorithms”

Tiny Wijerathna Ekanayake: Faculty of Computing, Sri Lanka Institute of Information Technology, Malabe, Sri Lanka. Pavani Subasinghe: Faculty of Computing, Sri Lanka Institute of Information Technology, Malabe, Sri Lanka. Shawn Ragel: Faculty of Computing, Sri Lanka Institute of Information Technology, Malabe, Sri Lanka. Anjalie Gamage: Faculty of Computing, Sri Lanka Institute of Information Technology, Malabe, Sri Lanka. Suchini Attanayaka: Faculty of Computing, Sri Lanka Institute of Information Technology, Malabe, Sri Lanka.

Publisher: IEEE (2019 International Conference on Advancements in Computing (ICAC)).

[5] “A Genetic Algorithm Solution for Scheduling Problem”

Ernesto Cortés Pérez: Ingeniería en Computación, Universidad del Istmo,

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Publisher: IEEE (2021 XVII International Engineering Congress (CONIIN)).