

Automated Time – Table Generator Using Genetic Algorithm

Atharv Katkar, Sanket Patil, Sarvesh Patravale, Soham Kamble, Yash Shaha, Vaibhav Pawar.

Guide - Prof. Milind Vadagave

Dept of Data Science Dr. D. Y. Patil College of Engineering & Technology

Abstract – Timetable creation is a very important job in schools as it helps to make sure that all resources are used appropriately and the students get an environment conducive for learning. In this paper, we introduce a new way of making them automatically using genetic algorithms for optimization. The method takes into account several restrictions such as availability of classes or subjects, preference of teachers about rooms they would like to teach in, size of rooms among many others which are necessary when generating optimized timetables for given sets of classes or resources.

The structure of our suggested algorithm has been borrowed from genetics. Some objectives were considered during fitness evaluation namely even distribution across days; minimum number of gaps between consecutive periods; conformity with rules. Additionally, a Graphical User Interface (GUI) was developed alongside the algorithmic design which allows easy interaction with the user for better understanding and experience on how the system works. Through this interface users are able to input constraints, view generated timetables and do other customizations thus making it more usable than just having command line-based program.

Key Words: Timetable, Genetic Algorithm, Optimization, GUI.

1. INTRODUCTION

The efficiency of class scheduling in educational institutions is important to ensure smooth running and proper utilization of resources. But making timetables manually is a tedious task that is also prone to errors, leading to poor schedules which may compromise the learning experiences of students as well as overburden teachers. This therefore necessitated the need for an automated timetable generator like ours which employs sophisticated algorithms and optimization techniques aimed at producing best-fit schedules based on specific limitations and preferences within educational establishments.

Our solution incorporates these requirements into its optimization process so that all created timetables can be valid according to the institution's needs. Therefore, it ensures that no two subjects or activities are assigned at same time slot otherwise one would not take place due to lack of space or materials required etcetera.

Moreover, our program has been designed with flexibility in mind hence it can handle complex situations where there are multiple classes being taught by different teachers on various subjects plus resource limited environments. This means that users have the freedom to specify their own preferences regarding what they consider most important when selecting genes for crossover during

evolution. Instructional establishments, leading to improved efficiency, decreased workload, and more desirable getting to know studies for college kids and teachers alike. By automating the tedious undertaking of timetable era, our device empowers instructional establishments to attention on their middle assignment of presenting first-rate training at the same time as streamlining administrative procedures.

2. Body of Paper

I. LITERATURE SURVEY:

The Despite the widespread computerization of college management tasks, timetable scheduling stays predominantly guide because of its inherent complexities. Manual scheduling consumes significant time and effort, because it involves allocating assets to various entities within spatial and temporal constraints.

The university lecture-timetabling trouble includes locating suitable slots and school rooms that adhere to constraints related to presented courses, teachers, and classrooms. This problem is classed as a combinatorial optimization hassle belonging to the NP-tough elegance, wherein computational time escalates exponentially with a growth in variables. Over the beyond decade, several tactics have been proposed to cope with timetable construction for instructional institutions. In our observe, we body this hassle as a constraint pride trouble and explore diverse approaches capable of coping with each tough and soft constraints. Hard constraints, which should now not be violated under any situations, encompass making sure that a single instructor isn't always assigned to two lessons simultaneously and preventing overlapping class schedules for college students and rooms. Soft constraints, even as necessary, are not as important; as an instance, timetables need to preferably limit instances where college students want to wait university for simplest one magnificence.

The challenges associated with magnificence scheduling and timetable technology in academic institutions had been extensively discussed in academic literature.

Existing studies on this area typically makes a specialty of optimizing scheduling approaches, enhancing useful resource usage, and improving user revel in. According to Kong and Kwok (1999), timetabling structures frequently appoint heuristic capabilities to improve scheduling overall performance and gain most fulfilling consequences. Genetic Algorithms and Memetic Algorithms are broadly recognized as powerful solutions for timetabling systems (Mohd. Dain et al., 2001). However, Causmaecker et al. (2002) proposed using the Semantic Web as a novel solution inside the timetabling domain, providing ability improvements in scheduling

performance. Berger and Barkaouia (2002) introduced a Parallel Hybrid Genetic Algorithm for the automobile routing problem, highlighting its speed, value-effectiveness, and competitiveness in comparison to standard heuristic routing methods.

Despite the provision of numerous answers, researchers maintain to searching for heuristics tailor-made to their specific challenges (Causmaecker et al., 2002).

While multiple solutions exist for timetabling systems, each technique has its precise strengths and barriers. Numerous online automated college timetable generation programs exist, each with its unique characteristics and functionalities. In this paper, we conduct a comparative analysis between our gadget and several of these current solutions.

By analyzing the variations in their respective processes and features, we aim to spotlight the awesome blessings and contributions of our gadget to the field of timetable technology.

Type 1; The procedure of preparing timetables for schools manually is frequently tedious and time-consuming, leading to issues which includes teachers having a couple of lessons simultaneously or conflicts among classes scheduled within the identical study room. To address these demanding situations, an automated gadget may be advanced using a pc-aided timetable generator. This machine will take various inputs along with the quantity of subjects, teachers, maximum lectures in line with instructor, and priority of subjects and topics to be blanketed. Based on those inputs, the system will generate feasible timetables for the working days of the week, optimizing the utilization of assets in the given constraints. From the generated answers, the most suitable timetable can then be decided on.

Type 2: Many timetable software programs generally tend to prioritize complexity of their layout, that can result in a loss of simplicity. However, this software adopts a fundamental and straightforward design, making it exceptionally reachable and efficient for small schools, schools, or educational institutes. Utilizing a spreadsheet layout, this software program gives ease of use even for amateur computer customers. One of its unique functions is its ability to acquire essential records dynamically as customers input information, removing the want to manually input information which includes the range of instructors, their names, or subjects. Users can begin constructing their timetables at once without the problem of pre-filling data.

II. EXISTING SYSTEM:

UniTime: UniTime stands out as an open-deliver organization answer tailored for universities, providing a big selection of scheduling functionalities encompassing route scheduling, examination timetabling, and event manipulate. It boasts superior optimization algorithms and configurable constraints to facilitate the arrival of inexperienced and warfare-loose timetables.

TimeTabler: TimeTabler, a commercially to be had software program package deal, enjoys vast usage for the duration of schools and faculties for its robust timetable generation competencies. Featuring a person-pleasant interface and intuitive system for constraint enter, TimeTabler employs several optimization strategies to offer well-balanced and optimized timetables.

aSc Timetables: Widely recognized, aSc Timetables caters to educational establishments of various sizes with its computerized timetable generation skills. Users can outline

constraints and options, allowing the software program to generate schedules for training, teachers, school rooms, and assessments seamlessly. Additionally, aSc Timetables gives multilingual assist and integration with other college manage systems. FET (Free Timetabling Software): FET emerges as an open-supply solution tailor-made for faculties, high faculties, and universities. It gives a consumer-pleasant interface for growing timetables based totally on constraints inclusive of teacher availability and study room capacity. FET supports each automatic generation and guide adjustments, offering flexibility in timetable introduction.

Existing timetable generator systems, notwithstanding their myriad advantages, also gift certain barriers and risks:

1. Complexity: Some modern-day systems may function difficult consumer interfaces or necessitate a steep attending to recognize curve, posing stressful conditions for customers, specifically people with constrained technical skill potential, to efficiently navigate and employ.

2. Limited Customization: While several structures provide customization alternatives, they'll have constraints in accommodating precise scheduling requirements or particular constraints of instructional establishments, resulting in plenty less-than-foremost timetables.

3. Cost: Commercial timetable generator software program programs can display costly, mainly for smaller instructional establishments with limited budgets. This financial issue may additionally limit get proper of access to advanced functionalities and assist offerings for certain customers.

4. Scalability Issues: Certain structures might encounter scalability demanding situations at the same time as faced with huge datasets or complicated scheduling situations. This must result in prolonged processing intervals and diminished average overall performance, specifically all through peak scheduling periods.

5. Integration Shortcomings: Integration with one of a kind school management structures or zero. 33- birthday party software program solutions may be restrained or absent in a few timetable generator systems. This should avoid seamless statistics trade and workflow automation, necessitating guide data access and reconciliation.

6. Maintenance and Support: Maintaining and updating existing timetable generator software program application can also name for big time, try, and resources. Additionally, the supply and first-rate of technical support and software updates may additionally fluctuate among one-of-a-kind providers, impacting system reliability and consumer contentment.

7. Reliance on Internet Connectivity: Cloud-on the whole based timetable generator solutions may additionally closely rely upon net connectivity for operation.

8. Compatibility Issues: Compatibility troubles with current hardware or software infrastructure might also arise, hindering seamless integration and interoperability with other structures used within instructional establishments. Mitigating those risks may want to pave the manner for the development of more person-pleasant, customizable, value-green, scalable, integrated, and dependable timetable generator answers tailored to the numerous desires of educational establishments.

III. PROPOSED SYSTEM:

Our proposed machine seeks to deal with several boundaries of existing timetable generator structures whilst introducing innovative functions to enhance performance, person revel in, and customization alternatives. It integrates superior optimization algorithms to make sure struggle-free and green timetables, prioritizing aid usage and dynamic variation to scheduling modifications. With an intuitive and person-friendly interface, users can without difficulty input constraints, choices, and scheduling parameters the usage of interactive equipment and visualizations.

One of the good sized benefits of our proposed system is its customizable constraints, permitting users to define a wide range of constraints tailor-made to their unique needs. This flexibility extends to cloud-based totally structure, providing scalability, accessibility, and real-time collaboration competencies across gadgets. Integration with existing instructional structures guarantees facts consistency and streamlined workflows, whilst robust security measures shield sensitive scheduling information.

Personalization is any other key function of our gadget, imparting users the capacity to customize timetable perspectives, notifications, and scheduling possibilities primarily based on their roles and preferences. Continuous improvement and help are important to our technique, with a devoted crew committed to improving the system based totally on consumer remarks and emerging technology.

By addressing those aspects, our proposed machine goals to revolutionize the timetabling process in academic institutions, empowering users with advanced capabilities, flexibility, and efficiency, thereby improving standard productiveness and satisfaction.

Our proposed timetable generator system goes past traditional scheduling solutions by way of introducing revolutionary capabilities designed to streamline the timetabling manner and decorate user pleasure. One such function is the inclusion of smart scheduling algorithms that utilize machine getting to know strategies to investigate ancient data and are expecting gold standard timetables based totally on past patterns and preferences. This predictive functionality permits the machine to proactively endorse timetable modifications and optimizations, saving users effort and time in guide scheduling duties.

Additionally, our system incorporates a collaborative scheduling framework that allows seamless verbal exchange and coordination amongst stakeholders, together with directors, instructors, and college students. Through incorporated messaging and collaboration equipment, users can without problems discuss scheduling options, solve conflicts, and make real-time changes to the timetable, fostering a collaborative and inclusive scheduling environment.

IV. SYSTEM ARCHITECTURE:

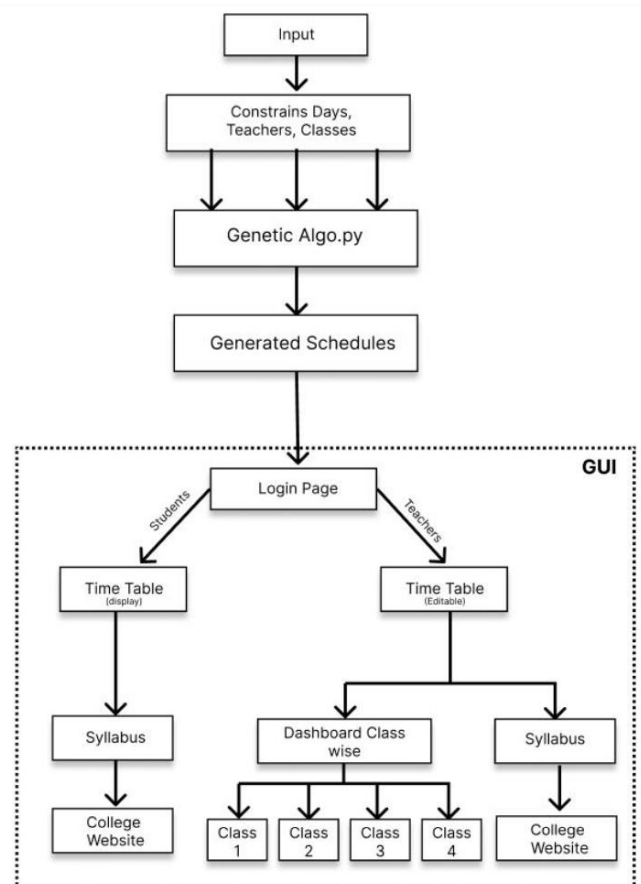


Fig-1: System Architecture

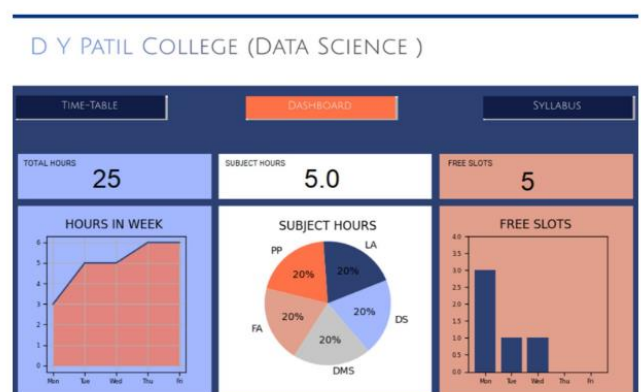


Fig-2: Sample GUI

V. SYSTEM SPECIFICATION:

Hardware Requirements:

- I. Processor: - Intel i3 and Ryzen 3 & above
- II. RAM: - 4 GB
- III. Storage: - 256 GB

Software Requirements:

- I. Operating system - windows 7 or Linux.
- II. Programming Language – Python 3.0

VI. ADVANTAGES OF PROPOSED SYSTEM:

Our proposed timetable generator machine gives numerous key benefits over current answers, positioning it as a modern-day and critical device for instructional establishments.

1. **Advanced Optimization Algorithms:** Our machine integrates cutting-edge optimization algorithms to make sure the creation of war-free and efficient timetables, minimizing scheduling conflicts and maximizing useful resource usage.

2. **User-Friendly Interface:** Featuring an intuitive and consumer-friendly interface, our gadget simplifies the method of inputting constraints, alternatives, and scheduling parameters, presenting interactive tools and visualizations for easy navigation.

3. **Customizable Constraints:** Unlike present structures with predefined constraints, our machine lets in customers to outline and personalize an extensive variety of constraints based totally on their specific needs and possibilities, making sure flexibility and adaptableness.

4. **Cloud-Based Architecture:** Leveraging cloud-based architecture, our system presents scalability, accessibility, and actual-time collaboration abilities, allowing users to get entry to the timetable generator from any tool with net connectivity.

5. **Integration with Existing Systems:** Seamlessly integrating with present college management structures and educational software solutions, our system ensures records consistency, interoperability, and streamlined workflows across extraordinary systems.

6. **Enhanced Security Measures:** Prioritizing records privateness and confidentiality, our machine implements strong encryption protocols, get admission to controls, and authentication mechanisms to safeguard sensitive scheduling facts.

7. **Personalized User Experience:** Offering customized user profiles and options, our machine lets in administrators, teachers, and students to customize their timetable perspectives, notifications, and scheduling choices, improving person engagement and pride.

8. **Predictive Analytics:** Our gadget contains sensible scheduling algorithms that analyze ancient records and expect greatest timetables primarily based on beyond patterns and choices, proactively suggesting timetable changes and optimizations.

9. **Collaborative Scheduling Framework:** Facilitating seamless communication and coordination amongst stakeholders, our system includes integrated messaging and collaboration equipment, enabling customers to discuss scheduling alternatives, remedy conflicts, and make real-time adjustments.

10. **Advanced Reporting and Analytics:** Providing superior reporting and analytics competencies, our machine gives precious insights into scheduling developments, resource usage, and overall performance metrics, empowering administrators to make knowledgeable selections and optimize scheduling techniques.

Overall, our proposed timetable generator device revolutionizes the timetabling method in educational

establishments, providing exceptional efficiency, flexibility, and insight into scheduling workflows.

3. CONCLUSION

In conclusion, the improvement and implementation of our proposed timetable generator machine constitute a sizable development in addressing the challenges associated with timetable scheduling in instructional institutions.

Through the combination of superior optimization algorithms, person-friendly interfaces, customizable constraints, cloud-based structure, seamless integration with current structures, more suitable security features, customized person studies, and continuous improvement and support, our gadget offers several blessings over current answers. By prioritizing performance, flexibility, accessibility, safety, and person pride, our machine empowers educational institutions to streamline their timetabling procedures, optimize aid utilization, and enhance usual productiveness. Moving forward, we stay dedicated to further refining and enhancing our system primarily based on consumer feedback, technological improvements, and evolving academic wishes, making sure its endured relevance and effectiveness in facilitating efficient and conflict-unfastened timetable scheduling.

REFERENCES

1. Kong, S. C., & Kwok, L. F. (1999). Automated timetabling system using heuristic search and knowledge-based reasoning. *Expert Systems with Applications*, 16(4), 401-4135.
2. Mohd. Dain, A. A., Shaari, N. S. Gom, Y. S., & Bacheck, Z. A. (2001). Memetic Algorithms: A Causmaecker, P. D., Demeester, P., & Vanden B. G. (2002). Evolutionary algorithms for the educational timetabling problem. *European Journal of Operational Research*, 143(3), 518-5325.
3. Berger, J., & Barkaouia, M. (2002). Parallel Hybrid Genetic Algorithm for the Vehicle Routing Problem. *Journal of Parallel and Distributed Computing*, 62(7), 1048-10605.
4. Abdullah, R., Deris, S., & Shamala, S. (2006). A parallel memetic algorithm for university course timetabling problem. *International Journal of Computer Science and Network Security*, 6(3B), 201-2085.
5. Achugbue, E. E., & Anyaoha, G. C. (2016). Design and implementation of an automated class scheduling system for tertiary institutions. *International Journal of Computer Applications*, 134(14), 14-215.
6. FET: Free Timetabling Software. (n.d.). Retrieved from <http://www.lalescu.ro/liviu/fet/>
7. UniTime. (n.d.). Retrieved from <http://www.unitime.org/>
8. aSc Timetables. (n.d.). Retrieved from <https://www.asctimetables.com/>
9. TimeTabler. (n.d.). Retrieved from <https://www.timetabler.com/>