

Design and Fabrication of Automatic Timetable Generator and Its Application

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Abstract

Making a schedule manually is exceedingly challenging in today's literate environment. Timetables must be made specifically for each branch and each year. It becomes quite chaotic, time-consuming, and labor-intensive to manually prepare the timetables. When a staff member needs to be substituted or is on leave, the process can occasionally become complicated. In our effort, we have developed a timetable-creation algorithm that will save a lot of time while lessening the workload and pressure on the employee. By using software to complete the task, much time is saved, and complex circumstances can also have schedules created. Additionally, it will prevent human error due to subject overlap and open positions. The creation of timetables is a difficult and time-consuming task, but it is essential to the coordination of many operations in educational institutions. The development of automatic timetable generation technologies has significantly streamlined this procedure, lowering labor costs and increasing productivity. This study paper offers a thorough examination and critique of the piece named "Automatic Timetable Generator." The fundamental ideas, methods, benefits, and difficulties of automatic timetable creation systems are examined in this work. It also examines how these systems affect educational institutions and identifies possible topics for additional study and development.

Keywords: Genetic algorithm, automated timetable, soft and hard constraints

INTRODUCTION

Lecture timetabling is a very important process and one of the common scheduling problems in any educational institution, which can be described as the allocation of resources for tasks under predefined constraints so that it maximizes the possibility of allocation or minimizes the violation of constraints.

A well-organized, seamless, and conflict-free schedule is essential to administering a learning facility or, more generally, an academic atmosphere. The educational organization manually developed the timetable in the past, before technology was widely used.

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Therefore, the necessity of switching to an electronic platform rather than a manual one cannot be overstated. Most schools have automated a number of other organizational areas, but due the various challenges involved, lecture scheduling is still done by hand.

The endeavor's timetable addresses all tasks related to creating a schedule that must be flexible in response to various restrictions. Timetable concerns tasks related to creating a schedule that

must be flexible in light of the various limitations. In educational institutions, making timetables, which involves planning a variety of activities like courses, tests, and events, is crucial. Historically, administrators have completed this procedure manually, devoting a significant amount of time and effort to it. But because of technical advancements and the spread of autonomous timetable creation technology, this task may now be accelerated and streamlined.

The manual creation of timetables is a difficult and time-consuming process that frequently results in mistakes and disagreements. Administrators must manually take into account a number of variables, including course options, room availability, instructor preferences, and student preferences. It is a difficult undertaking to balance these variables and develop an ideal schedule that satisfies the needs of all parties involved. Manual administration is made much more difficult by the possibility of cascading revisions brought on by changes in course offers, room availability, or instructor availability. By utilizing computer algorithms and methodologies, automatic timetable creation systems seek to resolve these issues. These systems automatically create an optimized schedule by taking into consideration a variety of restrictions, preferences, and requirements.

These systems can generate effective timetables that minimize conflicts, maximise resource utilization, and adhere to various limitations by making use of sophisticated scheduling algorithms, data structures, and optimization approaches. The benefits of creating timetables automatically are numerous. First, it drastically cuts down on the time and effort needed to create a schedule. Administrators may create a detailed schedule with a single click, saving time and money that could be used for other crucial activities. Second, these systems are capable of managing complicated scheduling restrictions like room capacity, instructor availability, and student preferences, assuring an equitable and balanced distribution of resources. Automatic timetable makers can also swiftly adjust to changes in course availability or offerings, which makes it simpler to manage dynamic situations. Additionally, automatic timetable creation systems maximize facility utilization by minimizing underutilized resources and minimizing underutilized resources [1].

LITERATURE SURVEY

When scheduling is modeled, it must cover both hard and soft constraints, that is, a set of various variables and values – such as halls, subjects, staff, and students – must be assigned in order to satisfy them. Therefore, we can conclude that the objective of the above method is to minimize the violation of soft constraints and satisfy the hard constraints.

The suggested method can be further modified to meet the needs of other academic institutions. To create faculty, classroom/laboratory, and student timetables, a wide range of limitations, categorized into soft and hard, are taken into account. The proposed algorithm has a n^3 level of complexity.

According to chronology, category, and application, the study gives a categorization of the approaches used in recent years [2]. We suggest two pattern-based formulations and a solution method that simultaneously builds and enhances solutions using column generation and a group of metaheuristics [3].

Heuristic and iterated local search algorithms (ILSA) take 44% of the time, graph coloring algorithm (GCA) takes 11%, genetic and graph coloring (GGCA) takes 25%, and heuristic algorithm takes 7% of the time [4]. This means developers can use imperative programming for business logic and declarative programming for user interface (UI) development [5]. The fitness score relates to the quantity of crashes that the timetable has experienced [6].

With the above survey of various research studies using different algorithms of automated time-table generator, we try to develop a software that helps to generate automatic timetable for a facility. We realize that the schedule generation is done manually when we take a look at the current system. When a faculty member is absent, the timetable must be manually adjusted, which presents a significant issue for the automatic schedule.

The generator automatically controls the timetable in the event of any teacher absence. As was already said, when creating the plan, the college's maximum and minimum workloads should be taken into consideration. Moreover, the process takes a long time [7].

Automated Timetabling System for University Course

The proposed algorithm can be further adapted to suit as per the requirements of different institutes and universities. It considers a wide range of constraints divided into soft and hard, to generate faculty, classroom/laboratory and student timetables. The complexity of the proposed algorithm is n^3 [8].

An algorithm has been proved effective for replacing an old-fashioned, time-consuming timetabling system with an enhanced, flexible, and automated automated system. The proposed algorithm saves hours of precious time which can be utilized in other areas.

1. A review of the most advanced optimization techniques for school scheduling issues
2. The study offers a chronology, category, and application-based categorization of approaches used in recent years.
3. The system's behavior in every conceivable scenario is captured by the optimization model.
4. A cooperative parallel metaheuristic and pattern-based model for high school scheduling issues is developed. We suggest two pattern-based formulations as well as a solution technique that simultaneously generates and enhances solutions using a metaheuristics team and column generation. It provides greater modeling capability and more easily implementable solutions [9].
5. *The Intelligent Scheduler*: A comparison of heuristic, iterated local search, genetic algorithms, and graph coloring.

In this method, timetable problem is dealt as graph problem and then the events are ordered using domain specific heuristics and then assign the events sequentially into valid time slots, so no constraints are violated for each time slot. Graph coloring algorithm (GCA) takes 11% of the time.

Using AngularJS and Bootstrap3 to Create an Effective Timetable System

As a result, developers can create user interfaces (UI) using declarative programming and imperative programming for business logic. With the aid of Angular Material and Bootstrap, a user-friendly GUI is offered. Using AngularJS, a single-page website is produced [10].

METHODOLOGY

The project provides a timetable without any kind of clashes.

There are three types of users in this system depending on the usage of the system. The user can either view the timetable or edit the timetable (admin) (Figure 1).

1. *Admin*: An admin has full authority to change the information for the other two entities and to create a new schedule. A manager will add, modify, and remove the student, subject, class or lab number, etc. The created schedule can be viewed by the administrator by faculty or by section.
2. *Student*: By getting messages from the admin side system, a student can rapidly examine the schedule and get updates. The learner finds it simpler to follow the schedule in this way because there is less confusion and a more effective schedule is created.
3. *Faculty*: A faculty member can view the timetable section wise and get the updates quickly by receiving the message from the admin side system. It becomes easier for the faculty to follow the timetable in this manner as minimum confusion and efficient timetable is generated.

User Interfaces

Login Screen

Login screen will enable the admin to login to the admin account to edit or generate timetable or student and faculty details. Also, it enables the students and faculty to view the timetable.

Administrator Page

The administrator has the ability to add or remove faculty, subjects, and classrooms. They must also assign subjects to teachers and assign classrooms while adhering to all restrictions. The timetable can be viewed by the administrator by part. There are two choices on the option screen:

- a. Modify the Details
- b. Schedule Timetable

SYSTEM ARCHITECTURE

The block diagram in Figure 2 gives an overview of the approach towards building a basic version of the intended features for the timetable.

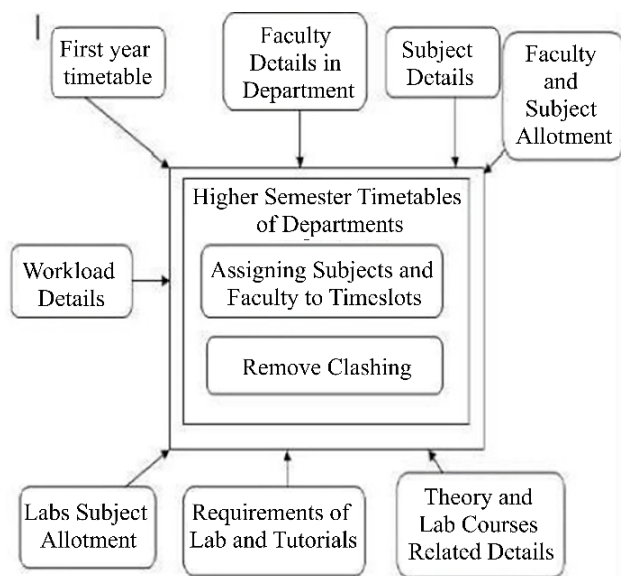


Figure 1. System design of timetable.

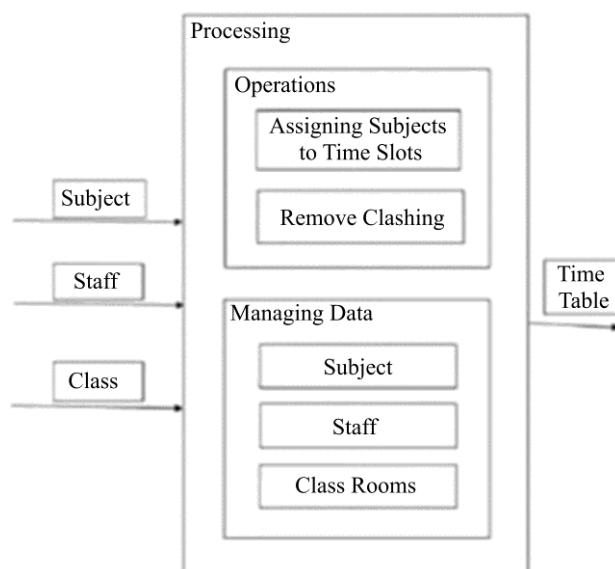


Figure 2. System architecture.

The workflow for timetable generation is as follows:

1. Admin will modify all the details of the student, faculty, and subjects.
2. Admin will generate the timetable by providing the input as subject, faculty, type, etc.
3. Admin will update the timetable and notify the students and faculty.

4. The timetable will be generated without any clashes and satisfying all the constraints.
5. Appropriate lab or class will also be allotted for the session.
6. Students and faculty will get the updated timetable message on their registered mobile number.
7. Students and faculty can login to their account using their personal login.
8. The timetable can be viewed by the students as per their details provided.

CONCLUSION

The process of creating a schedule is covered in this report, which will always be simpler with a computerized programme than it would be to manually create a schedule from a spreadsheet, which could result in difficult-to-define constraint issues. The relevant information about courses, classrooms, and faculties is supplied to the automated system for timetable generation and is stored in a database (SQL server). The automated system for timetable generation creates the schedule based on the aforementioned database details in the shortest amount of time while meeting all requirements.

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