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Smart Web Application for Automatic Timetable Generation for Scheduling of Classes

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ABSTRACT: Faculties in many institutes spends tremendous amount of time in generating timetable for whole institute either for examination purpose or for scheduling lecture, they have to clear many hurdles so that there should be no collisions in assigning classes and teachers to students. So to reduce the efforts of faculty to create timetable for both purpose it is possible to create a system that can generate timetable with some given input constraints. This system may take inputs such as number of subjects and teachers, classrooms available, labs availability which will reduce the workload of faculty to generate timetable. This helps in providing optimal solution.

KEYWORDS: Timetabling, Genetic Algorithm, Graph Colouring.

I. INTRODUCTION

Timetabling is procedure to allocate classes and teachers to students in such a way that there are no clashes such as one teacher assigned to more than one class at a time or a student is attending more than one examination at a given time. Creating timetables for examination or lectures manually is time consuming process and also require lots of efforts. Even though most work of organizations are now computerized but still many organization use traditional way to create timetable manually. Now, using automated system, efforts and time spend by faculty to create timetable manually can be reduced to great extent by giving some inputs to the system which then automatically generates timetable as per requirements of the organization.

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There are multiple approaches made in past time to solve the problem of scheduling timetable for organization. The problem of scheduling can be implemented with numeral methods such as Genetic Algorithm (GA), Graph Colouring Approach, from backtracking etc. In our project, our main aim is to satisfy all the required constraints both hard and soft constraints. Hard are those constraints which cannot be violated and soft constraints are those which are not essential but if they are satisfied the solution will be more desirable.

Genetic Algorithm is an optimization technique which is based on iterative search procedures. It is based on the principle of Genetics and Natural Selection. It is mostly used to find solution in an optimized way, which problem can take lifetime to solve. Graph Colouring is method of labelling graph components such as vertices, edges and some graphical regions under some constraints. A colour is given to a region, vertex or edge, in such situation the same colour cannot be given to its adjacent region, vertex or edge respectively.

II. LITERATURE SURVEY

“Dipti Srinivasan Tian Hou Seow Jian Xin Xu” [1] states that finding suitable timetable within a vast university department may be a challenging problem encountered continually in educational establishment. This paper gives an evolutionary algorithm (EA) based approach to resolve a heavily constrained university timetable problem. This approach uses a problem specific chromosome representation. Heuristic and context based reasoning are used for obtaining suitable timetable during a rational computing time. Intelligent adaptive mutation strategy has been implemented to accelerate the convergence. But this technique is difficult to implement given that it contemplate entire university problem and evolutionary algorithm.

Antariksha Bhaduri “University Time Table Scheduling using Genetic Artificial Immune Network” [2] in their article states that scheduling is one of the crucial tasks in real world circumstances. Several scheduling problem exists, such as personnel scheduling, education timetable scheduling, production scheduling, etc. Educational timetable scheduling can be inconvenient task due to various constraints that are needed to be fulfilled in order to get a suitable solution. Educational timetable scheduling is understood to be NP hard (non-deterministic polynomial-time hard). Due to this reason evolutionary technique have been used to deal with the timetable scheduling problem. Approaches like genetic algorithm (GA), evolutionary algorithm (EA), etc. are used with mixed success. Within this paper, they have reviewed the difficulty of the educational timetable scheduling and resolving it with genetic algorithm. They have additionally solved the problem with Genetic Artificial Immune Network (GAIN), mimetic hybrid algorithm and compared the results that are obtained from genetic algorithm (GA). Results show that the GAIN is faster to reach to the optimal feasible solution compared to the genetic algorithm.

“Shengxiang Yang, Member, IEEE, and Sadaf Naseem Jat”[3] proposed that the University Course Timetabling Problem (UCTP) is a combinatorial optimising problem. In UCTP, a set of events have to be scheduled within time slots and placed in suitable rooms. The designing of timetable for universities is exasperating because it is NP hard problem. This paper scrutinize genetic algorithm (GA) and local search (LS) approaches for the UCTP. The guided search strategies which is employed here is to make offspring into population on the basis of data structure that stores information collected from good individuals of previous generations. The local search approach use their exploitative search ability to enhance the search efficiency of the proposed genetic algorithm and the quality of people. The proposed genetic algorithm is tested on two sets of benchmark problems as compared with set of state-of-the-art approach from literature. The experimental results exhibits that proposed genetic algorithm is capable of giving promising results for the UCTP.

III. PROPOSED METHODOLOGY AND DISCUSSION

The Automated System for Timetable Generation generates timetables for universities, colleges and schools, keeping in mind the circumstances such as availability of teachers, classrooms and labs. It also precepts different levels of limitations on classrooms, semesters, teachers and subjects. Overall, the Automated System for Timetable Generation staggeringly enhances resource's optimization and application.

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For generating timetable for any institute or organization, Graph Colouring approach gives the idea how to implement an algorithm to generate a timetable. Similar to graph colouring approach chosen subject and subject teacher can be considered as a specific colour in graph colouring approach. According to the approach the given subject should not get repeated for the day and in similar way the subject teacher should not teach in more than one classroom for the same time.

Several constraints got to be met satisfactorily so as to invoke application of variable about time slots and classrooms. The constraints are often categorized into hard constraints and soft constraints as follows:

Hard constraints:

Hard constraints are the one's which must be fulfilled imperatively.

1. More than one lecture cannot be allotted to a classroom at an equivalent time.
2. More than one class cannot be taught by a teacher at the same time.
3. Courses for equivalent year students of a department should occupy different time slots.
4. The classroom within a course is to be conducted should be substantial enough to occupy the students attending the lecture of the particular course.
5. The classrooms should provide the necessary facilities to the class attending a particular course's lecture.

Soft constraints:

These are the constraints that are not that obvious but still challenging. They are not necessarily fulfilled but the solutions are usually considered adequate if substantial number of them are taken care of.

1. No successive lectures of a teacher within the class.
2. Lecture of same teacher should not be repeated within the class.
3. Reduce the successive lecture of same course within a day.
4. Allocation of fixed slots for particular subjects and practicals.

A selected object such as subject cannot get repeated on the same day, in similar way another object teacher/faculty should not attend more than one classroom and also one classroom should not take more than one class at a time. Also all practicals should be performed at most once in a week. Fixing all this constraints it is possible to generate a basic schedule for any institute. Similarly to generate any schedule it only require some basic constraints after which it will be possible to generate a basic schedule for any events of organisation.

The Automated System for Timetable Generation will be able to generate the timetable entirely in automated way which reserves the time and efforts invested by the administration. The Automated System for Timetable Generation will be comprehensive in such a way that it will operate for other universities, colleges and schools. The Automated System for Timetable Generation application's code could be altered according to the constraints of particular needs of university, college or school. It is easy to handle and use for the user so that the timetable could be generated in automated way. The Automated System for Timetable Generation also focuses on the resource optimization such as teachers, classrooms and labs. The generated timetable could also be viewed for the exploration.

IV. EXPERIMENTAL RESULTS

Admin can add or delete teachers, subjects and classrooms also have to allot subjects to teachers and allot classroom. Important is that all constraints should be satisfied. Admin can view the timetable only according to semester, whereas each faculty will be able to view its timetable using their unique faculty id.

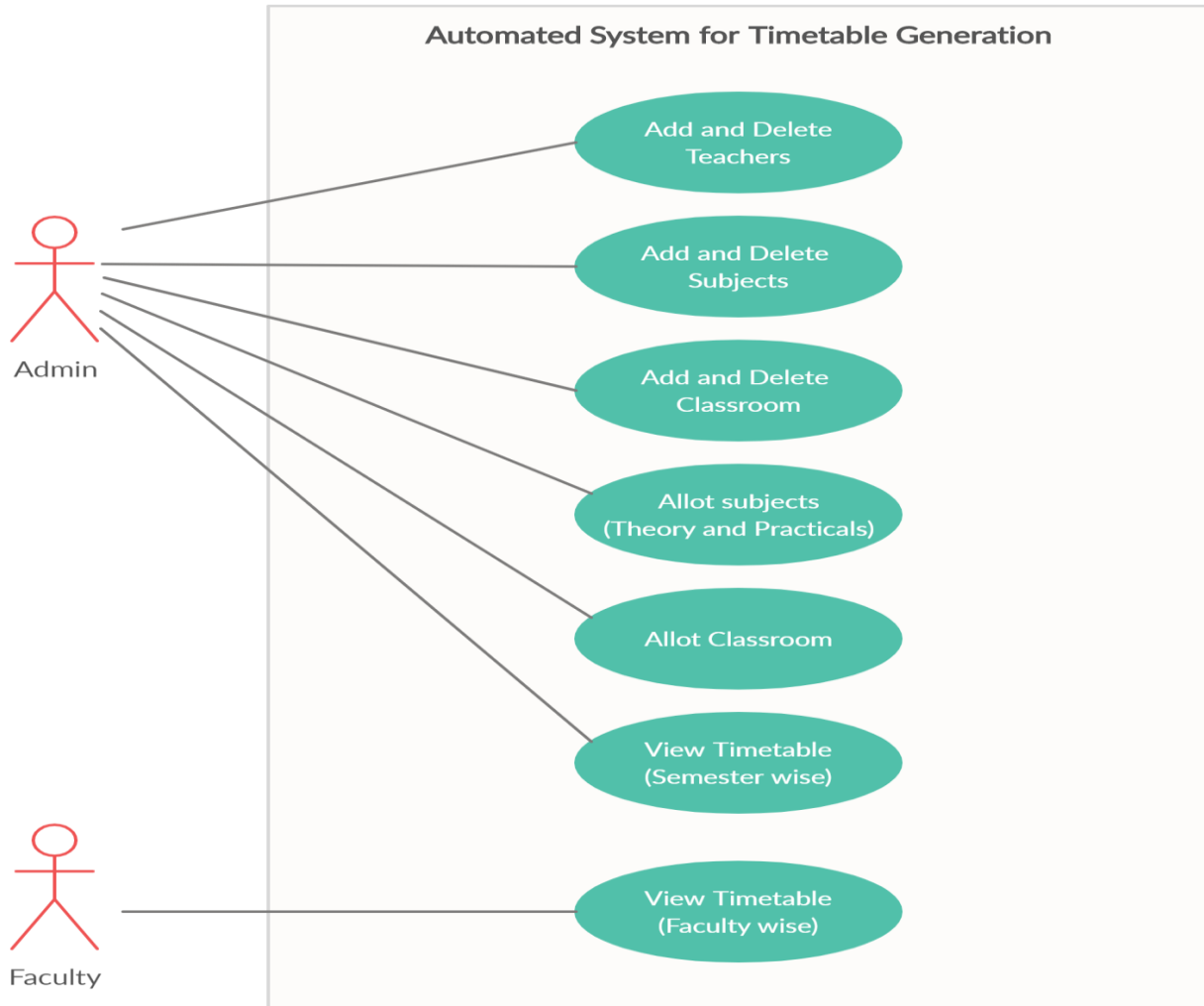
Use case diagram for system can be as shown below:

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Below picture shows a kind of output that can be generated using automated system for timetable generation for two sections of same class or year.

COMPUTER ENGINEERING DEPARTMENT SEMESTER 3 ()

WEEKDAYS	1st Slot	2nd Slot	3rd Slot	4th Slot	5th Slot	6th Slot
MONDAY-A	M3 DVK	PM KHD	Practical -	Practical -	CO PND	-
TUESDAY-A	PM KHD	EDC ABP	CO PND	-	Practical -	Practical -
WEDNESDAY-A	EDC ABP	DS SGT	Practical -	Practical -	M3 DVK	-
THURSDAY-A	DS SGT	CO PND	M3 DVK	PM KHD	Practical -	Practical -
FRIDAY-A	CO PND	M3 DVK	PM KHD	EDC ABP	DS SGT	-
MONDAY-B	M3 ASP	PM PPD	EDC ABP	DS KRH	Practical -	Practical -
TUESDAY-B	PM PPD	DS KRH	Practical -	Practical -	EDC ABP	M3 ASP
WEDNESDAY-B	DS KRH	EDC ABP	CO SPI	PM PPD	Practical -	Practical -
THURSDAY-B	DS KRH	CO SPI	Practical -	Practical -	M3 ASP	-
FRIDAY-B	CO SPI	M3 ASP	PM PPD	-	-	EDC ABP

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V. CONCLUSION

The procedure of the timetable generation will be consistently easier with Automated System for Timetable Generation than using spreadsheet manually which might lead to constraints problem that are arduous to establish when timetable is generated manually. The Automated System for Timetable Generation is provided with necessary details of courses, classrooms and faculties which are stored in database (SQL server).

The Automated System for Timetable Generation generates timetable based on these details in database with minimum time and satisfies all the constraints.

There are few points that justify the need of this system:

1. User friendly.
2. Faster and better generation of timetable.
3. Saving of time and manpower.

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