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Automatic Timetable Generation

Dr. G. Prabhakar Raju
M.Tech, Ph.D., Assistant Professor
CSE, Anurag University
Hyderabad, India

Sai Charan Reddy Gongireddy
CSE, Anurag University
Hyderabad, Telangana

Shirisha Ganaji
CSE, Anurag University
Hyderabad, Telangana

Sai Prathibha Nampally
CSE, Anurag University
Hyderabad, India

P. Nitish Goud
CSE, Anurag University
Hyderabad, India

Abstract*— Creating the right schedule for school can be a difficult and time-consuming task. The process includes scheduling lectures, labs, and exams, including course requirements, instructor availability, and other restrictions. In this project, we offer a course schedule creator application that can be used to create course schedules for schools. Using the instructions in the course list, teacher availability, and other constraints, the application creates a schedule that meets all constraints and minimizes conflicts. The app uses an algorithmic approach combined with genetics to create optimal schedules i.e., Genetic Algorithm. Evaluate the performance of the system by comparing the generated times with its own generated times and conducting user studies. The results show that the planning process can create efficient and accurate schedules and save time and resources for schools. The system also allows for customization and flexibility, allowing organizations to adjust parameters and preferences to create a program that meets their specific needs.

***Keywords*— Scheduling, schedule creator application, Genetic algorithm, Customization.**

Introduction

Automated Planning using genetic algorithms represents a way to improve the planning process, especially in schools. This new computer can use the power of genetic algorithms to create efficient programs that meet certain criteria and goals. Thanks to heuristic optimization caused by natural selection and genetics, the schedule, class hours, availability of teachers, etc. can be iterated to generate optimal solutions with many changes in constraints. This article presents the methods and advantages of planning using genetic engineering and highlights its potential to revolutionize school management.In the management of education, the allocation of resources and time is important to ensure effective and efficient work. The day-to-day processing of time sheets often requires labor-intensive processes that are prone to errors and inefficiencies. To solve these problems, automatic job scheduling using genetic algorithms appears to be a promising method with the ability to replace school syllabus. Automated planning using genetic algorithms represents a new way to plan generations based on best practices through natural selection and genetics. This decision-making process is designed to increase the efficiency of the project and improve resource utilization by creating plans that meet criteria and objectives in advance.The purpose of this research article is to investigate the methods and results of automatic planning using genetics in the context of the curriculum created for schools. By highlighting the complexity of this approach, we aim to demonstrate its flexibility to optimize the planning process and improve overall project quality. Additionally, this article aims to explain the purpose of automatic generator scheduling using genetics, including elements such as efficiency, activation quality, flexibility, and scalability.By evaluating all these goals, we aim to highlight the benefits and applications of this new technology. Additionally, this article also provides an in-depth look at the importance of selecting appropriate data for successful planning using genetic algorithms. By dividing the data set into inputs, constraints, and outputs, we aim to highlight their importance in facilitating the creation of good opportunities.In summary, this study attempts to advocate the widespread use of automatic plan genetic algorithms as an alternative to time production in schools. By harnessing the power of this new technology and using appropriate data, organizations can unlock new ways to work more efficiently and effectively across their programs.

Literature Survey

1. EXISTING SYSTEM

The university's manual scheduling system is exceedingly tedious and time-consuming, often resulting in the overlap of classes taught by the same instructor or clashes between multiple classes. Many universities offer numerous courses spanning various subjects, with a limited number of instructors assigned to each department. The current manual approach to scheduling is inefficient due to its lack of automation. To address these challenges, an automated system equipped with a schedule generator can be devised. This system would take into consideration several parameters, including the number of subjects, available teachers, maximum lectures per teacher, and the priority of subjects and topics to be covered. By analyzing these inputs, the automated system would generate viable timetables for each working day of the week, effectively optimizing the allocation of resources within the specified constraints.

In the past, timetable generators utilized various techniques to create schedules for educational institutions. Initially, manual methods were employed, which proved to be time-consuming and error-prone. These manual approaches involved assigning teachers and classes to specific time slots and iteratively refining schedules. With advancements in computer technology, a variety of algorithms have been developed to automate the scheduling process. These algorithms encompass brute force, simulated annealing, and genetic algorithms. Nonetheless, older algorithms often struggled with complex constraints or lacked flexibility in creating schedules. Recently, hybrid algorithms have gained popularity, combining multiple optimization techniques such as genetic algorithms, taboo search, and simulated annealing. The earlier timetable generators also suffered from limited user interfaces, requiring users to possess a strong understanding of the algorithm and timetable constraints. This posed a challenge for users lacking a technical background, hindering their effective utilization of these systems. Over time, timetable generators have evolved into more efficient and user-friendly systems. They now possess enhanced capabilities to handle intricate constraints and generate tailored timetables for diverse educational institutions, marking a significant advancement from their earlier counterparts.

2. *RELATED WORK*

- In a paper authored by E.K. Burke and B. McCollum, titled "An Evolutionary Algorithmic Approach to University Course Timetabling" *[2]*, a method employing genetic algorithms is presented to address the university course timetabling problem. The proposed algorithm integrates local search techniques and crossover operators to produce optimal timetables.

- F. Firdausi et al. discuss their genetic algorithm-based solution for the school timetabling problem in their paper titled "Genetic Algorithms Applied to School Timetabling". The algorithm utilizes a blend of crossover and mutation operators to generate optimized and feasible timetables.

- M. R. A. Rahman et al. conduct a comprehensive examination of genetic algorithm-based methodologies for university course timetabling in their paper "Exploring Genetic Algorithms for University Course Timetabling" *[5]*. This review critically evaluates various genetic algorithm-based approaches, identifying their strengths, weaknesses, and areas for future research.

- In "Optimizing Nurse Rostering Using Genetic Algorithms" *[6]* authored by E.K. Burke et al., a genetic algorithm framework is proposed to solve the nurse rostering problem. The algorithm integrates crossover, mutation, and local search operators to generate high-quality nurse rosters.

PROPOSED METHODOLGY

The school planning process is often confusing and ineffective due to instructional constraints and disciplinary diversity. To increase control and efficiency, this article proposes the use of genetics in the planning process. The planning process will facilitate knowledge creation by addressing materials such as study numbers, teacher availability, and the importance of education. It will create an efficient plan optimized for weekly limits using a genetic algorithm. Historically the process of producing books has been flawed. With the development of computers, algorithms such as genetic algorithms for automatic planning have emerged. However, the limitations of traditional algorithms lead to the development of hybrid methods. Compared to the old system, the proposed system offers a good solution to the customer according to the needs of the school. It facilitates interaction between stakeholders and enables better performance by adapting to future changes. In summary, using genetic algorithms for learning automation planning should improve efficiency and resource utilization, thus increasing the effectiveness of the learning environment.

Fig. 1. System architectur

A. *Genetic Algorithm*

Genetic algorithms are a way to solve problems based on abstract knowledge about the process of natural selection. Instead of creating problems, they try to mimic the situation by adapting solutions. The genetic algorithm works similar to natural selection as shown below.

First, the pool of chromosome groups is checked. Chromosomes are strings of characters or numbers. There is a big example of this in that humans are identified using four alphabetic characters in DNA. Chromosome is also called genotype (the coding of the drug) as opposed to the phenotype (the drug itself).

In the genetic algorithm, maintains a chromosome pool of sequences. The safety of chromosomes must be evaluated. Bad solutions are weeded out and existing solutions are modified ever so slightly, and then "natural selection" is allowed to take its course and the genetics are modified to find something better solution.

The main concept of the genetic algorithm is as follows:

For each generation, start a random pool

```
{
choose the best solution to breed new humans
solve their parents by creating new humans
Just measure new exercise
Replace old ones with new ones
}
```

The pool is opened the first time will not be good. However, many generations have progressed for various reasons.

1. *Selection*

The procedure that shows the selection of the floating filter used in the system is used. This mode decides whether keeps or cancels the option (regardless of whether it is a plan, price plan, carry, or option). If it's about Bollinger values. Returns TRUE if the option is accepted, FALSE if it is rejected. This does not return a NULL value. Practical system.

2. *Crossover*

The methodology is executed through the courseconflict.java module within the system. It involves adjusting resources to evade conflicts by shifting them either to the right or left. In all scenarios, the offspring are initially generated by combining traits from both parents. When creating new offspring, a random portion of the Room and Time fields is inherited from the first parent, while the remainder is obtained from the second parent. The crossover point varies for each field.

3. *Mutation*

Conversion is a different business. Its purpose is to occasionally remove one or more members of the group from the local minimum/maximum position and find the minimum/maximum position. The transfer of chromosomes is carried out by calling various functions such as weight training, cycling, unit usage. It can be done through the following possibilities. The first two documents are changed randomly in the chromosomes in room and time the randomly selected content is changed, two randomly chosen lessons are changed over time, and the other two are changed over time spent in rooms.

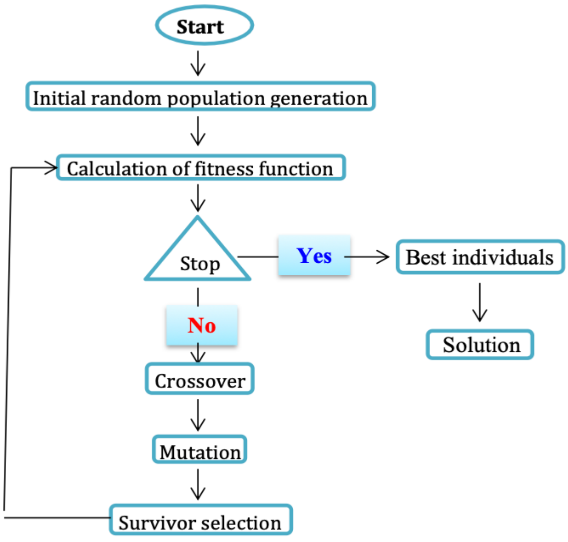

Fig. 2. Flowchart of Genetic algorithm

DESIGN AND IMPLEMENTATION

This section describes all proposed strategies based on computational genetics. The plan is divided into several important modules. The guidebook is ready to be a problem to be completed and we find a solution that suits the needs. Many solutions to scheduling problems in colleges and universities have been proposed in the past. The problems of the period can be understood by using various techniques such as paintings learned from researching the work, local ideas such as taboo films, reconstruction tempering, genetic algorithms or limited applications based on backtracking.

A. *System requirements*

Backend and Algorithm

- Java 8
- Struts-2 framework
- Java Server Pages
- Servlets

Database

- MySql database

Frontend Design

- HTML5
- Cascading style sheets (CSS)
- Javascript
- Bootstrap
- Ajax

B. *Evaluation of population*

Evaluating the magnitude of the transaction using precise commands is called transaction availability. Regulations are very important now. The basis of the genetic algorithm is group evaluation. This step measures whether exercise time is better than others. Running 1 to 1 (where 1 is generally considered the best combination) can be used to decide and other people run them. In this case, power rank 1 and power rank 0 will constantly change.

C. *Evaluation of population*

$$F(X) = \frac{\rho 1\,(x) - \rho v\,(x)}{\rho 1\,(xWT) - \rho v\,(xWT)}$$

Where, $\rho 1(x)$ = Average density of the sequence of x.
$\rho v(x)$ = Analogue for the poor phase.

X indicates timetable that is being evaluated

W is the number of restrictions

T = Value of overall fitness.

D. *Crossover and Mutation*

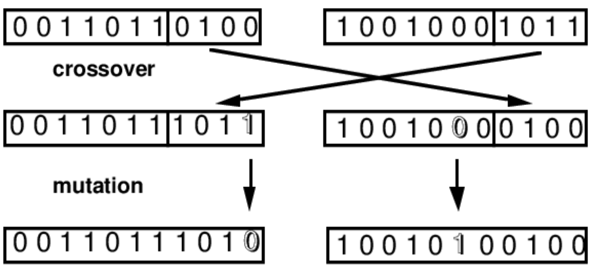

Fig. 2. Crossover and Mutation

Results and Analysis

A. Login page

The login page authenticates the students and teachers to access the application by entering their usernames and password. And there is also registration page if one wants to create an account.

B.Add slots per days and no.of days per week

It provides the structure of the timetable how it can be designed. We can also add break after which period it has to be, and it also provide a room to create uneven time slots.

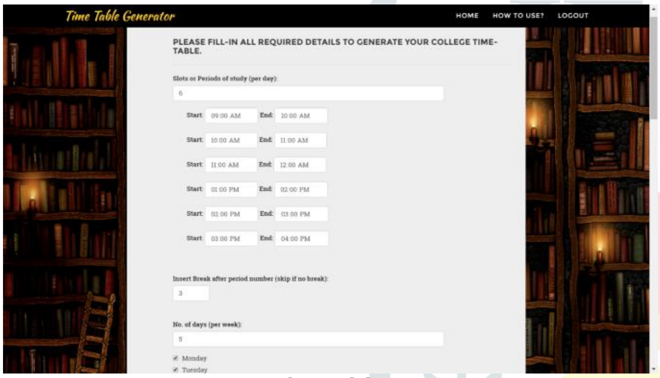

Fig. 2. Slots and days

B. Add teachers and batches

First we need to enter no.of teachers, their names and the subjects they teach. After that no.of batches that is needed to be filled and divide the teachers accordingly.

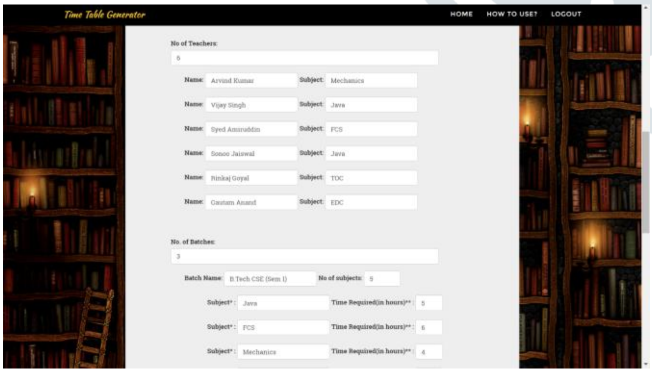

Fig. 2. Teachers and batches

C. Results

B.TECH ECE (SEM 1)

	09:00-10:00	10:00-11:00	11:00-00:00	Break	13:00-14:00	14:00-15:00	15:00-16:00
Day 1	FCS Syed Amiruddin	TOC Rinkaj Goyal	EDC Gautam Anand			EDC Gautam Anand	FCS Syed Amiruddin
Day 2		Java Sonoo Jaiswal	FCS Syed Amiruddin		EDC Gautam Anand	FCS Syed Amiruddin	
Day 3			Java Sonoo Jaiswal		TOC Rinkaj Goyal	Java Sonoo Jaiswal	EDC Gautam Anand
Day 4		Java Sonoo Jaiswal	FCS Syed Amiruddin		Java Sonoo Jaiswal	FCS Syed Amiruddin	
Day 5	EDC Gautam Anand	TOC Rinkaj Goyal	TOC Rinkaj Goyal		TOC Rinkaj Goyal	Java Sonoo Jaiswal	EDC Gautam Anand

B.TECH IT (SEM 1)

	09:00-10:00	10:00-11:00	11:00-00:00	Break	13:00-14:00	14:00-15:00	15:00-16:00
Day 1	EDC Gautam Anand	Java Vijay Singh	FCS Syed Amiruddin		EDC Gautam Anand	TOC Rinkaj Goyal	EDC Gautam Anand
Day 2	Java Vijay Singh	Mechanics Arvind Kumar	TOC Rinkaj Goyal		Java Vijay Singh	Java Vijay Singh	Java Vijay Singh
Day 3	TOC Rinkaj Goyal	FCS Syed Amiruddin	FCS Syed Amiruddin		EDC Gautam Anand	Mechanics Arvind Kumar	FCS Syed Amiruddin
Day 4	EDC Gautam Anand	EDC Gautam Anand	EDC Gautam Anand		FCS Syed Amiruddin	TOC Rinkaj Goyal	EDC Gautam Anand
Day 5	Mechanics Arvind Kumar	Mechanics Arvind Kumar	Mechanics Arvind Kumar		Mechanics Arvind Kumar	TOC Rinkaj Goyal	TOC Rinkaj Goyal

B.TECH CSE (SEM 1)

	09:00-10:00	10:00-11:00	11:00-00:00	Break	13:00-14:00	14:00-15:00	15:00-16:00
Day 1	TOC Rinkaj Goyal	Mechanics Arvind Kumar	Java Vijay Singh		FCS Syed Amiruddin	FCS Syed Amiruddin	Java Vijay Singh
Day 2	EDC Gautam Anand	EDC Gautam Anand	EDC Gautam Anand				TOC Rinkaj Goyal
Day 3	Mechanics Arvind Kumar	EDC Gautam Anand	Java Vijay Singh		Java Vijay Singh	Java Vijay Singh	
Day 4	TOC Rinkaj Goyal	Mechanics Arvind Kumar	TOC Rinkaj Goyal		TOC Rinkaj Goyal	EDC Gautam Anand	FCS Syed Amiruddin
Day 5	FCS Syed Amiruddin	FCS Syed Amiruddin	EDC Gautam Anand		FCS Syed Amiruddin	Mechanics Arvind Kumar	

Fig. 2. Results

Here the results are based on the no.of batches we have provided earlier. In the above example we have given three batches so the final output has three printable timetables based on the info we provided.

Conclusion

Automatic time generators using genetic algorithms represent a significant advance in planning and resource management in schools. The system provides an efficient solution to the complexity of timesheets in both working and non-working conditions. Using genetic algorithms, the system can create the most appropriate program that meets the differences and interests of schools. By automating the production process, the system saves time and resources while increasing efficiency. It also increases student and teacher satisfaction by reducing conflicts and errors over time. Going forward, there are many opportunities for further development and improvement of the automatic generator. Optimizing performance goals can be optimized to address other factors, such as student performance and teacher preferences. Integration of machine learning algorithms can improve performance by learning from previous data. Instant data feeds and cloud computing can enable systems to adapt to dynamic change and collaborate better within the organization. Additionally, potential applications of electronic scheduling systems continue to be explored to include healthcare, transportation, and emergency management. As technologies such as virtual reality and augmented reality continue to evolve, user experience and real-time interaction can be further enhanced. Fundamentally, automatic planning systems using genetic algorithms show great promise in optimizing the planning process and improving overall management. Various fields. As research and development in this area continues, we expect further advances and innovations to improve practices and make organizations more efficien

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