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Automated timetable generator for educational institutions using graph colouring technology

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Abstract

Scheduling of timetable is one of the important tasks come across in real life circumstances. Timetable problem is a NP-hard problem where different constraints and various resources are applied but the resources are limited. In this paper, Graph Colouring Algorithm is used to generate the weekly time table of the student for the college. We describe the software of the Graph Colouring Algorithm to a highly constrained real-world occurrence of the College course timetabling problem. By using this software we get an effective preparation of courses and events where complex combinations of resources must be assigned efficiently to timetables. It test all the constraints applied and also check all the clashes and eliminate it.

Keywords: Graph colouring algorithm, timetable, hard constraints, soft constraints, conflicts-free, optimal

1. Introduction

This paper could also be a practical timetabling approach having ability to perform and care of every laborious and soft constraint required for making timetable. As we all recognize the strategy of constructing program manually for colleges, universities and in educational activity is extremely time exhausting which needs immeasurable effort as we've to require care of assorted constraints and facts, as we all know the smallest constraints will take plenty of your time and in some worse condition once the number of constraints or the number of information to handle will increase then accessible resources are not absolutely and properly utilised [2].

The graph colouring algorithm is used in this paper which, is designed in a user-friendly method. Simplicity of use and speed of the application distinguishes from existing approaches with these powerful features. The main application of graph colouring algorithm is Timetable generation. Results are achieved in a fast manner using the algorithm mentioned. The application established here can give effective results in a few seconds while tabular process can take minutes or hours with similar applications.

Figure 1 illustrates a simple timetabling problem instance using graph colouring algorithm in which we have five courses to be scheduled: Maths, Distributed Operating System (DOS), Information Cyber security (ICS), Database Management System (DBMS) and Operating Systems (OS).



Fig 1: graph colouring [9]

2. Methodology

2.1 Graph Colouring Algorithm: In graph theory, The graph colouring algorithmic program may be a special case of graph labelling; it's an assignment of labels historically referred to as "Colours" to parts of a graph, subject to certain constraints. In its simplest type, it's some way of colouring the vertices of a graph such no two adjacent vertices share an equivalent colour. This is often referred to as a vertex colouring. Graph colouring is one in every of the foremost vital ideas in graph theory and is employed in several real time applications in computer science [1]. Graph

colouring employed in varied analysis areas of computer science such datamining, image segmentation, clustering, image capturing, networking etc. and vital applications such as Guarding an Art Gallery, Physical layout segmentation, Round-Robin Sports Scheduling, Aircraft scheduling, Biprocessor tasks, Frequency assignment, Final Exam Timetabling as a Grouping Problem, Map colouring and GSM mobile phone networks, and Student Time Table [3].

3. Working

3.1 Data flow diagram

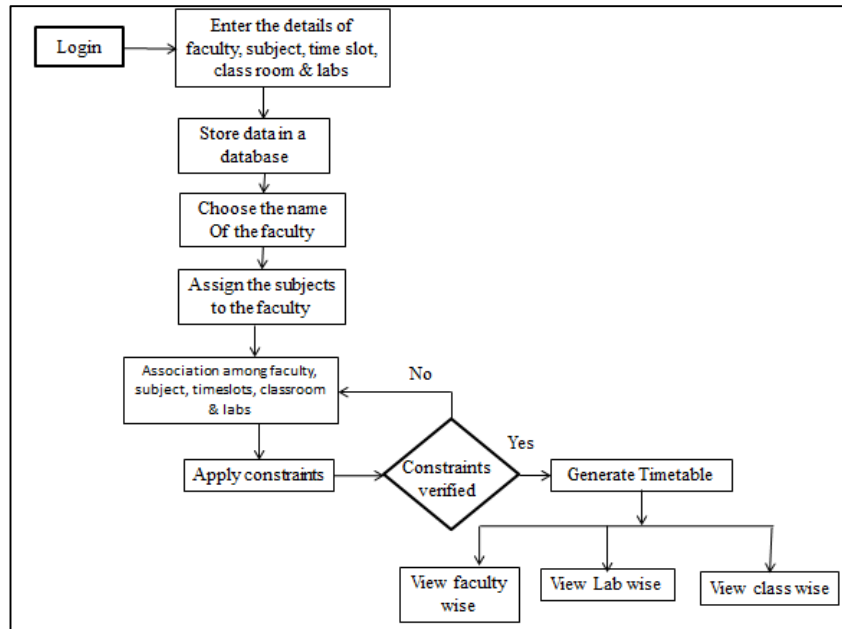


Fig 2: Data flow diagram of timetable generator [8]

The above figure 2 shows the flow of timetable generation using the Automated Timetable generator which contains the contribution of Graph colouring algorithm. The above figure shows a flow of following procedures: There is one admin in the software who will handle the software. The admin have to login into the system by entering their id and respected password. The admin have to enter each of the records as number of faculties available, counts of subjects, class-rooms, labs, lectures, students and timeslots. The data will be store in the database for further process. The admin will choose the name of the faculty and allot each subject to

them and also assign classrooms and the students whom they will teach. The software then starts association among the faculty with their subjects and classrooms. The constraints will be applied as specified in the algorithm so that no conflicts occur. Same procedure will be repeated until satisfactory results will be generated. After successful verification the Timetable will be ready for the staffs and students to view with respected to class, faculty and labs [7].

4. Results

DAY	1	2	3	01:00 - 01:45	4	5	6
TIME	10:00-11:00	11:00-12:00	12:00-01:00		01:45-02:45	02:45-03:45	03:45-04:45
MON	CCS/SCT (SPT/SRG)	DOS (PMM)	AWSN/NLP (VRM/RNI)		ICS (PSB)	QUANT / REASONING	
TUE	DOS (PMM)	AWSN/NLP (VRM/RNI)	ICS (PSB)	R	CCC/SCT (SPT/SRG)	PROJECT	
WED	AWSN/NLP (VRM/RNI)	ICS (PSB)	CCC/SCT (SPT/SRG)	E	DOS (PMM)	DOS/ICS B1/B2 PMM/MIS ACDSL/OSL	
THU	ICS (PSB)	CCC/SCT (SPT/SRG)	DOS (PMM)	S	AWSN/NLP (VRM/RNI)	TECHNICAL EXPOSURE	LIBRARY
FRI	CCC/SCT (SPT/SRG)	DOS (PMM)	AWSN/NLP (VRM/RNI)	S	ICS (PSB)	ICS/DOS B1/B2 MIS/PMM OSL/ACDSL	
SAT	PROJECT PL				T & P ACTIVITY		

ABBREVIATION :	
SUBJECTS	
DOS	Distributed Operating
ICS	Information and Cyber
CCC	Clustering and Cloud
AWSN	Advance Wireless Sensor
SCT	Soft Computing Tech.
FACULTY	
PMM	Pranay Meshram
PSB	Pradhya Borkar
SPT	Sagar Tete
VRM	Vijay Manthana
SRG	Shweta Gajbhiye
PRACTICAL LAB	
ACDSL	Advance C And Data
OSL	Operating System Lab
CWSL	Computer Workshop Lab

Fig 3: Generation of class wise timetable

In above figure, we have gathered overall information of any semester like odd semester and even semester. In odd semester we are generating 3rd, 5th and 7th semester class wise timetable and meanwhile in even semester we are generating 4th, 6th and 8th semester class wise timetable. We are shuffling the generated output as per the convenience after

satisfactory we can save that timetable without any conflict. The generated timetable shown in colour and colour represents non-overlapping time slot. Meanwhile we are also showing abbreviation of teacher name, lab name and subject name in this way remaining class wise timetable are also displayed [4].

DAY	1	2	3	01:00 - 01:45	4	5	6
TIME	10:00-11:00	11:00-12:00	12:00-01:00		01:45-02:45	02:45-03:45	03:45-04:45
MON			DOS (PMM)	R E C E S S		DOS/ICS B1/B2 PMM/PBA ACDSL/OSL	
TUE		DOS (PMM)			DSPD (PMM)		
WED	DOS (PMM)		DSPD (PMM)			ICS/DOS B1/B2 PBA/PMM OSL/ACDSL	
THU		DSPD (PMM)				DOS (PMM)	
FRI	DSPD (PMM)		DOS (PMM)				
SAT			DSPD (PMM)				

Fig 4: Generation of personal timetable

In above figure, the personal timetable of teachers is displayed. In class wise timetable, we are showing overall timetable of teacher with their respective classes and subjects but in personal timetable we displayed only single

person's timetable at a time it means this timetable shows only work of only single teacher with respect to their practical and classes [5].

DAY	1	2	3	01:00 - 01:45	4	5	6
TIME	10:00-11:00	11:00-12:00	12:00-01:00		01:45-02:45	02:45-03:45	03:45-04:45
MON				R E C E S S		DOS/ICS B1/B2 PMM/PBA ACDSL/OSL	
TUE					DSPD/OS/CWS2 B1/B2/B3 PBA/SRG/SPT ACDSL/OSL/CWSL		
WED						ICS/DOS B1/B2 PBA/PMM OSL/ACDSL	
THU						OS/CWS2/DSPD B1/B2/B3 SRG/SPT/PBA OSL/CWSL/ACDSL	
FRI						CWS2/DSPD/OS B1/B2/B3 SPT/PBA/SRG CWSL/ACDSL/OSL	
SAT							

Fig 5: Generation of lab wise timetable

In above figure, the lab wise time table is displayed. In lab wise timetable we have shown only the lab name and their respective subjects with faculty. In this timetable one lab is

busy or engaged with any particular subject at a time that means not more than one subject engaged in the lab [5].

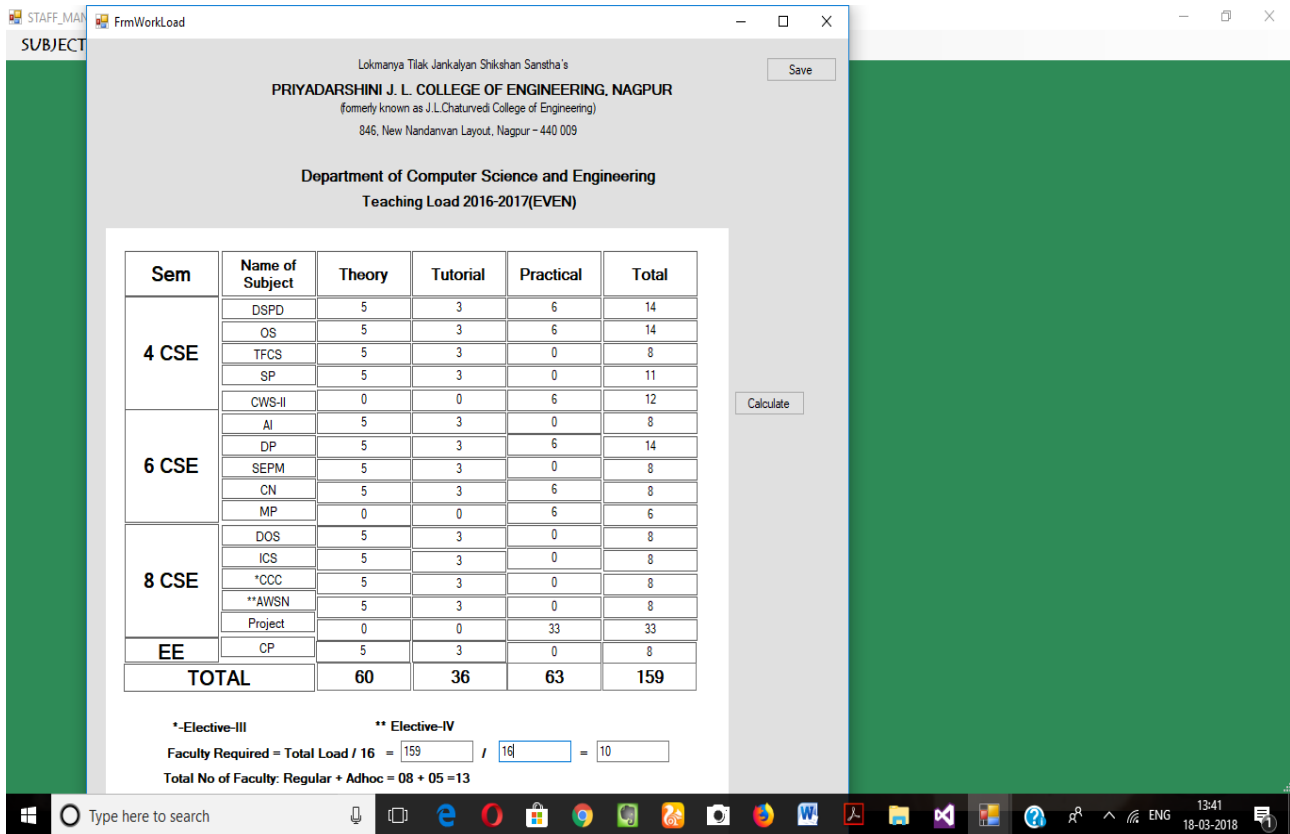


Fig 6: Calculation of workload

Above figure shows the workload of teachers, the workload is generated weekly as per their subject and schema. In workload all subjects are shown to us with respect to even and odd semester. Workload is generated, when we give the entry to all subjects who are shown in the workload table. In this we gives the loads to the practical and subjects etc. and at last calculate the total load and divided the total load by maximum hours and hence final workload of the week is generated. The workload is calculated as per the university schemes [5].

5. Conclusion

This paper has presented a successful approach of automated timetable generator by applying a Graph colouring technique. The graph colouring algorithm evenly distributes resources among available time slot without conflict. This timetabling software is user friendly, robust and flexible. It gives efficient optimization, unique and interactive approach to satisfy user requirements of varying nature. It is very helpful specifically for the educational institutions which faces various problems in generating the Timetable, removing various subjects, teacher, classroom, labs overlapping as well using their conventional softwares or manual methods. This software is a boon for such needy users. It has a capability to resolve the conflicts and can be applied on large dataset and events.

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