

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 4, April 2019

# Quality Resource Management System for Autonomous Colleges

Bharati Kulkarni<sup>1</sup>, Aditya Kumbhar<sup>2</sup>, Sagar Rane<sup>3</sup>, Anish Samant<sup>4</sup>, Reena Kharat<sup>5</sup>

U.G. Student, Department of Computer Engineering, PCCOE, Nigdi, Maharashtra, India<sup>1</sup>

U.G. Student, Department of Computer Engineering, PCCOE, Nigdi, Maharashtra, India<sup>2</sup>

U.G. Student, Department of Computer Engineering, PCCOE, Nigdi, Maharashtra, India<sup>3</sup>

U.G. Student, Department of Computer Engineering, PCCOE, Nigdi, Maharashtra, India<sup>4</sup>

Professor, Department of Computer Engineering, PCCOE, Nigdi, Maharashtra, India<sup>5</sup>

**ABSTRACT:** This paper proposes a novel approach for educational institutions for quality resource management. The need for automatic course allocation and generation of appropriate time schedules for both students and faculty can be satiated with implementation of the proposed system. The paper also shows how the system can be used to absorb and handle irregularities caused due to elective courses, thus reducing redundant manual work and implementing time efficient management.

**KEYWORDS:** Constraint programming, FCFS, Genetic Algorithm, Load Balancing, MVC architecture, NP Hard.

### I. INTRODUCTION

An institution has various courses to offer. Allocation of courses and resources to the students and staff members becomes an exhaustive task if done manually. Furthermore, generation of timetable is one of the most time consuming and tedious tasks to perform. Manual allotment of courses and resources makes the entire system static and hence any run time changes may become very difficult to accommodate.

This project aims at automating the entire system of course and resource allocation. The application will automatically allot courses to the students and faculties depending on their respective preferences while satisfying all important constraints. It will also generate a timetable for each class considering various hard and soft constraints. The system will show a run time log of available resources such as classrooms, seminar hall, etc. which the privileged users can access and make bookings. Any changes to be done to the allotment of courses will be handled by certain privileged users (admin) after request from the faculties and students regarding the same.

### II. RELATED WORK

Resource allocation, course allocation and timetable generation are one the most compound and largely faced problems. Though there are easy ways to perform these tasks, the results are not quite appreciable. Moreover, traditional methods do not take into consideration all the constraints which are important when it comes to maintain a healthy and productive workspace for teachers as well as students.

When it comes to course allocation, in the past years, many intellects have proposed countless solutions, using techniques in combinatorial auction design, matching theory and integer programming. FCFS is normally used these days in most of the universities to allocate courses [1].

But FCFS does not satisfy all the requirements and constraints while considering an unbiased system. So to make the system less complex and more productive, in this project, we propose using a matching algorithm and constraint programming approach [2]. All the historic data will be stored in the server database. From this data we will find out the perfect domain of teacher, suppose taking into considerations his/her research work, their post-graduation

# International Journal of Innovative Research in Science, Engineering and Technology

*(A High Impact Factor, Monthly, Peer Reviewed Journal)*

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 4, April 2019

specializations or the courses they've taught in the past. Mapping all these points and converting them into singularity, we can find out the best suited course for a particular teacher.

When it comes to resource management, say the timetabling problem which is a NP hard problem, countless solutions have been proposed for the system. Surely one solution is the use of random function, but this does not really take into consideration the constraints that the manual timetable generators face in real life. Another solution to this is Graph Coloring. In graph coloring the model takes advantage of the structural properties of conflict graph instances that arise from university timetabling problems, and is based on the effectiveness of a variety of graph coloring approaches [3]. These are intelligently-ordered and intelligently-searched sequential coloring methods, as well as integer and constraint programming formulations of graph coloring in solving such problems.

The drawback of using this technique is that if there are a large number of entries, this algorithm is not efficient. The complexity increases and it takes a huge amount of time to generate the results. There is only one single solution generated from graph coloring [3]. Whereas we require a set of optimal solutions which best fits the constraints and the user will get the freedom to choose amongst the optimal solutions.

Next possible way to solve this problem is using Genetic Algorithm. Genetic algorithm is popularly used to solve constraint satisfaction problems which require optimal searching of a solution in infinite search space [4]. After creating an initial population, best genes are chosen and the next generation is generated using few properties from them. But there is a chance of getting stuck in locally optimum solution which isn't desirable. Hence, we use mutation function to change few bits in the generation to come out of local minima and explore even more optimal solutions[5].

Resource management also includes handling of runtime allocation of class rooms, laboratories or seminar halls. If need arises the concerned authority must be able to see the available alternatives and book the same immediately. We will be using the concept of seat booking system to implement this functionality where the users can see runtime status of rooms and accordingly make their bookings which will in turn be reflected in the system [6].

Once the system is deployed, maintaining the servers and ensuring smooth and buffer free surfing for the users is another challenge. Because the system is developed for university programs the number of users accessing the system at a time say while giving their preferences regarding a course will be high. To ensure that the system is scalable with respect to the amount of users we propose load balancing technique which will efficiently distribute the incoming traffic across a group of backend servers [7].

## III. PROPOSED SYSTEM

### A. System Overview

Q.R.M.S. is part of the college automation system which is responsible for generations of timetable for various classes across departments. As it is a web application, the proposed system will be a role based system wherein each user will be categorized into student, faculty or admin. Admin will have the highest privileges and can add, delete, and update any user's details. The Faculty user can give preferences for courses to teach for the semester and similarly, students can give preferences for courses to opt.

Our system will follow MVC architecture on which Java Spring Boot is based. Client can access the system using web browsers which will render the HTML web pages sent by the application View module. As we are using TCP/IP, each time some request has to be made either JSON request or xml request will be used. The controller module will handle all the requests and interact with the database to perform required operations. After this appropriate response will be sent back to the client. The whole application will be deployed on a cloud hosting platform and the Load Balancing will be done by underlying Kubernetes cluster [8].

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 4, April 2019

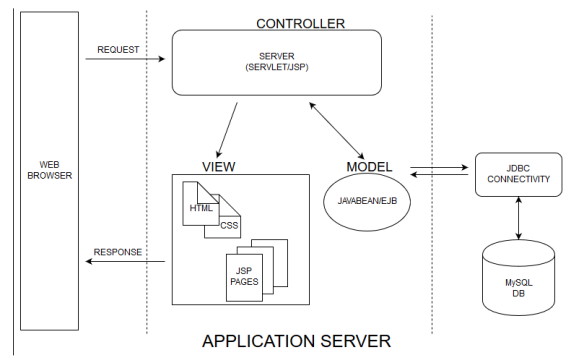


Fig. 1. System architecture.

## B. User Classes

### 1. Admin Class

- The admin user is responsible for inserting all the data required by the system, which includes student data, faculty data and course data.
- There will be different permissions to the admin and faculty.
- The system aims to automate the course allocation, time table generation, faculty- wise subject allocation.
- Some of the automated outputs of the system may be undesirable in some scenarios, so manual modification of allotments is needed for convenience.
- For this reason, admin users will be able to modify/adjust the automated allotments.

### 2. Faculty Class

- Faculty will be able to update and modify their profile.
- Faculty can send request for change of allotted course.
- Faculty can give their preferences for teaching a course at the beginning of the semester.

### 3. Student Class

- Student will be able to login to the system and change their password, update phone number, email and residential address.
- Students will have a choice of choosing their elective subjects.
- Along with departmental electives, there is an open elective to be chosen, in which the students need to choose an elective subject belonging to other departments.
- The system will have a single portal for all students and will accept their preferences. Students can modify their choices before the deadline.
- After deadline is crossed, the system will evaluate the choices and assign the electives to the students based on the intake capacity and the students' percentage result.

## C. System Modules

The primary modules that will be covered in the project will be course allocation, resource allocation and time-table generation.

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 4, April 2019

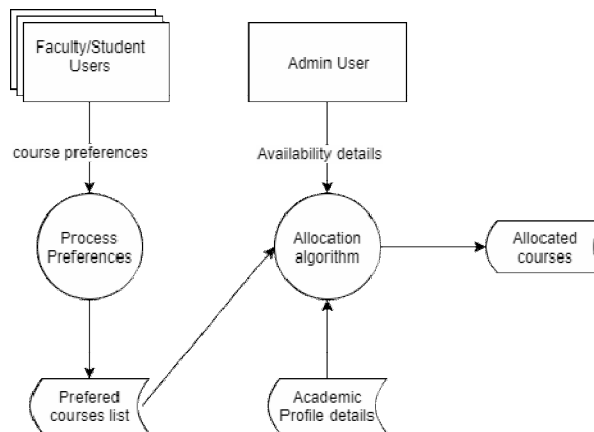


Fig. 2. Course Allocation Data Flow

### 1. Course Allocation to Faculty

The system will take the preferences given by the faculties and allot the courses to them considering the factors like qualification of faculty, past experience in the particular subject, history of subjects taught. The admin can further make custom modifications depending on the request and need.

### 2. Course Allocation to students

The system will take the preferences given by the students and:

- Allot the courses to them solely based on their overall marks.
- Priority will be given to the students having higher grades.
- Once the seats in a particular course are filled the remaining students will be accommodated in the remaining courses.

The admin can further make custom modifications depending on the request and need.

### 3. Resource Allocation

Resources include class rooms, laboratories, seminar halls, auditoriums etc. The allocation of class rooms and laboratories will be done along with time table generation. Resources will be allocated to a particular class depending on the following factors:

- Strength of class
- H/W and S/W requirements of the subject to be taught.
- Faculty preferences

### 4. Time-table Generation

Time-table generation is a NP-hard problem. The system will implement genetic algorithm to generate the time-tables.

Genetic algorithm is an iterative 5 step process:

1. Initial population
2. Fitness function
3. Selection
4. Crossover
5. Mutation

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 4, April 2019

The algorithm may take the following hard and soft requirements as conditions to satisfy as inputs to the genetic algorithm.

- Hard Requirements
  1. One faculty should not be allocated to multiple divisions at the same time.
  2. Multiple divisions should not be allocated the same class room at the same time.
  3. Same subject must not appear multiple times in a single day.
  4. A particular subject must be allotted exactly the required number of hours per week.
  5. Faculties should not be allocated with consecutive lectures.
  
- Soft Requirements
  1. A faculty prefers to teach during particular hours in a day.
  2. A faculty prefers a particular class room.

The basic idea of the algorithm is as follows:

1. The algorithm takes the above inputs and generates possible timetables.
2. Next the generated time tables are checked for fitness depending on the requirements they satisfy.
3. The fit outcomes are then selected and paired with each other.
4. These paired outcomes then go through cross over to generate new outcomes.
5. The new outcomes are mutated copies of their parents which are again checked for fitness.

This is an iterative process and steps 2 to 5 are performed iteratively until the best possible time table is generated [9].

## IV. EXPERIMENTAL RESULTS

### FACULTY-TO-COURSE

**Current Scenario:**The faculty-to-course allocation prioritises the availability of the faculty along with their choice of interests. This results in faculties getting allotted the subjects they don't have prior experience in.

**Application Results:**The system considers the experience of the faculty in that particular course along with their experience in the prerequisite courses which need to be taught before teaching the course.

**Conclusion drawn:** This ensures that the faculties with prior experience in teaching that course are allotted to that course and availability is not a major factor in allocation. Also speeding up the process of allocation.

Following table compares the results of manual process with the system generated results and shows the correlation between faculty experience and the allotted course.

	Manual Process	System Generated Results
Correlation	73%	91%

Table 1: satisfaction comparison between manual process and system generated results

### STUDENT-TO-COURSE

**Current Scenario:** The current student-to-course allocation process is manual and time consuming. Also adjusting the seats and selection of student for a particular course with limited seats is very hectic.

**Application Results:** The system considers the preferences given by students and estimates the total number of seats for a particular course. After fixing the batch strength the system enrolls the students as per their preferences and resolving conflicts by comparing the aggregate marks of the students.

**Conclusion drawn:** The allocation process becomes faster and manual errors are avoided.

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 4, April 2019

Following data is used for computation:

Number of students: 200

Number of courses: 1 (The course has 4 sub courses under it)

Every student will give 4 preferences where preference1 means most interested while preference4 means least interested. The students will then be allotted one of the four sub courses based on their preference and course's fulfilment criteria.

	subCourse1	subCourse2	subCourse3	subCourse4
Preference1	55	40	5	100
Preference2	45	30	50	75
Preference3	60	80	50	10
Preference4	40	50	95	15

Table 2: Student-to-Course Allocation input data

Now considering the preference1 of all the sub-courses the admin will decide number of seats to allot to a particular sub-course. Here, only 5 students have given preference1 as subCourse3, so subCourse3 will be discarded and those 5 students will be allotted their further preferences depending on the satisfiability criteria.

subCourse4 being the most popular course will be divided into 2 batches so as to maintain the student to classroom ratio into a batch of 50.

subCourse1 and subCourse2 will be managed accordingly to maintain the 50 students'. The students who are unable to make the batch of 50 will be allocated their further preferences depending on the satisfiability criteria.

	subCourse1	subCourse2	subCourse4 Batch1	subCourse4 Batch2
No. of students	50	50	50	50

Table 3: Student-to-Course Allocation output info

## DYNAMIC RESOURCE ALLOCATION

Current Scenario: Currently there is no real time resource monitor that keeps track of the availability of resources.

Application Results: The system keeps track of resources and their availability which the authorized users can view and lock any particular resource at any given time.

Conclusion drawn: Easy and hassle free booking of resources as and when required.

## V. FUTURE SCOPE

Initially the prototype will be restricted to certain courses and resources taken into consideration. The project can be extended to accommodate dynamic requirements of different institutional programs for valid courses.

Extended modules include e-learning module which will help students see online lectures recorded by faculties. This will allow the students to go through the contents of the lectures numerous times, whenever required.

The system will also have a chat bot which will serve as an assistant for the users accessing the website. It will also serve as an easy guide for the users regarding the features and functionalities of the website and will give quick response to specific queries without requiring the user to navigate the entire website [10].

# International Journal of Innovative Research in Science, Engineering and Technology

*(A High Impact Factor, Monthly, Peer Reviewed Journal)*

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 4, April 2019

## VI. CONCLUSION

There was always a need for an automated system which could handle the manual and tedious tasks of department administration, majority of which include course allocation based on preferences and timetable generation. The project has been undertaken to tackle these issues and greatly ease the functioning of college departments.

Different methods for solving the problem have been explored and the most suitable ones have been chosen for implementation. Various existing systems have been studied and the architectural model to be implemented has been built upon them. The model ensures coverage of all basic use cases and also leaves scope for future modifications or feature additions.

## REFERENCES

- [1] Fairuz Rauf, Youagenrajc Kalai Sevan and Zuraidy Adnan, "Course Allocation System for Lecturers" in International Journal of Computer Applications (0975 – 8887), vol. 180 – No.22, pp. 9-14, 2018.
- [2] Archana Magare, Yamini Kutumbale, "Time Table Generation using Constraint Programming Approach", in International Journal on Future Revolution in Computer Science and Communication Engineering, pp. 269-272, 2018.
- [3] Baki Koyuncu and Mahmut Seçir, "Student Time Table by Using Graph Coloring Algorithm", Ankara University Computer Engineering Department, pp. 2-6, 2007.
- [4] D. Abramson and J. Abela, "A Parallel Genetic Algorithm for Solving the School Timetabling Problem" in 15 Australian Computer Science Conference, Hobart, pp. 1-9, 1992.
- [5] Alberto Coloni, Marco Dorigo and Vittorio Maniezzo, "A Genetic Algorithm to Solve the Timetable Problem" in Computational Optimization and Applications Journal, pp.1-24, 1994.
- [6] Gabriel Iwasokun, Raphael Akinyede, Temitayo Balogun, "Design and implementation of an online booking system for a cinema house", in Journal of Information and Computing Science, p. 113-122, 2017.
- [7] Ragmani, Awatif; El Omri, Amina; Abghour, Nouredine; Moussaid, Khalid; Rida, Mohammed, "A performed load balancing algorithm for public cloud computing using ant colony optimization" in Recent Patents on Computer Science, pp. 179-195, 2018.
- [8] K. Takahashi, "A portable load balancer for kubernetes cluster" in International Conference on High Performance Computing in Asia-Pacific Region, p. 222-231, 2018.
- [9] Asif Ansari and Prof. Sachin Bojewar, "Genetic Approach Time Table Generator-A Case Study" in International Journal of Innovative Research in Computer and Communication Engineering, p. 8694-8699, 2016.
- [10] Abdul-Kader, Dr. John Woods, "Survey on Chatbot Design Techniques in Speech Conversation Systems", in International Journal of Advanced Computer Science and Applications, pp.72-80, 2015.