

A Synopsis on

# **AUTOMATIC TIMETABLE GENERATOR USING GENETIC ALGORITHM**

Submitted in partial fulfillment of the requirements  
of the degree of

**Bachelor of Engineering**

in

**Information Technology**

by

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## CERTIFICATE

This is to certify that the project Synopsis entitled "***Automatic Timetable Generator using Genetic Algorithm***" Submitted by ***Harsh Bhanushali (16104043), Greshma Sapra (16104038), Surbhi Saroliya (16104037)***" for the partial fulfillment of the requirement for award of a degree ***Bachelor of Engineering in Information Technology*** to the University of Mumbai, is a bonafide work carried out during academic year 2019-2020

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## Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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# Abstract

Time table generation is tedious job for educationalist with respect to time and man power. Providing a automatic time table generator will help to generate time table automatically. Proposed system of our project will help to generate it automatically also helps to save time. It avoids the complexity of setting and managing Timetable manually. In our project we are going to use algorithms, resource scheduling to reduce these difficulties of generating timetable. These algorithms incorporate a numeral of strategy, aimed to improve the operativeness of the search operation. The system will take various inputs like number of subjects, teachers, workload of a teacher, semester, priority of subject. By relying on these inputs, it will generate possible time tables for working days of the week for teaching faculty. This will integrate by making optimal use of all resources in a way that will best suit the constraints. Most colleges have a number of different courses and each course has a number of subjects. Now there are limited faculties, each faculty teaching more than one subjects. So now the time table needed to schedule the faculty at provided time slots in such a way that their timings do not overlap and the time table schedule makes best use of all faculty subject demands. The traditional hand operated method of time table is very time consuming and usually ends up with various classes clashing either at same room or with same teachers having more than one class at a time which is being resolved by Automatic Timetable Generator System.

# Introduction

Even though most college administrative work has been computerized, the timetable scheduling is still mostly done manually due to its inherent difficulties. The manual timetable scheduling demands considerable time and efforts. The lecture-timetable scheduling is a Constraint satisfaction problem in which we find a solution that satisfies the given set of constraints. A college timetable is a temporal arrangement of a set of lectures and practical's in which all given constraints are satisfied. Creating such timetables manually is complex and time consuming process. By automating this process with computer assisted timetable generator can save a lot of precious time of administrators who are involved in creating and managing course timetables. Using this system Authority can concentrate on other things rather than wasting their time on preparing Timetable.

Automatic Timetable Generating basically aims on User defined constraints handling, Ease of use for user of system so that he/she can make automatic timetable, Focus on optimization of resources i.e teachers, laboratories and rooms etc., Provide a facility for everyone to view timetable, Generate multiple useful views from time table. The project reduces time consumption and the pain in framing the timetable manually. The project is developed in such a way that, no slot clashes occur providing features to tailor the timetable as of wish. Additional features that is included in the project is that there is no headache of Giving much input.

Our system will take the basic inputs such as subjects, class rooms, laboratories, faculties, semester, and number of students in each batch. The inputs will be processed further and the given set of constraints provided in proposed system will be applied on it, further it will be validated and the system will check whether all the requirements are fulfilled or not. Once, validated the system will generate a review of the timetable which if approved will be stored in the database and will provide different views of the timetable like class timetable, lab time table, faculty time table and master timetable which can be printed anytime.

The Automatic Timetable generator is a system for educational organization which will be helpful for creating Timetables. It is a great difficult task that to manage many faculties and allocating subjects for them at a time manually and this system will help to manage it properly and very conveniently. This manages timetable for faculty and for students with considering minimum workload and can be managed easily.

# Objectives

The main objectives are:

1. To reduce the load on Time table coordinator.

Time table generation is a tedious and time consuming task also it takes lots of effort from the coordinator end to check the clashes of faculties while assigning slots to them,also the coordinator has to satisfy the load constraint.

2. To minimize the manual intervention in creation of the timetable.

Time table generation at present is completely based on human efforts but the system will reduce the human effort to minimum level,the effort from human end will be to provide the system with loadsheets ,review the data and forward it to the algorithm.

3. Generates multiple useful views from timetable.

Time table once generated has multiple data in it,the system will provide different views of the time table to the user such as faculty view,student view and lab view.

4. To make timetable system generic so that it can work equally well for different Schools,Colleges and Universities.

The system built will just require a standard format of data which once provided can generate time table for any school,college and university.

# Literature Review

The paper referred are mentioned below:

[1] Asha, V. G., Babu, K. N. R. M. (2017). On-line help desk for college departmental activities. 2017 International Conference on Intelligent Computing and Control Systems (ICICCS) IEEE (2017).

- This paper refers to the varied computer machinery and software used to digitally create, collect, store, manipulate, and transfer the information needed for accomplishing basic tasks in a college department. The On-line help desk is a combination of multiple sub modules which are required for college department automation activities. This includes 1. Automatic Timetable generation which is used for generating the time table for the course, which also includes adding, deleting and updating a course, faculty, classroom and lab to generate the timetable. 2. Automatic Internals timetable generation which is used for generating the time table for the internal examination. 3. Student profile management which includes adding, deleting and updating student's personal information, previous education information, academic information and other non-academic information. 4. Library management which is used for barrow and return of books from department library by students and faculty. Using Genetic algoritms all these modules are implemented. Genetic algorithm comes under the class of evolutionary algorithms that use the principle of natural selection to derive a set of solutions towards the optimal solution.

[2] Yang, X. F., Ayob, M., Nazri, M. Z. A. (2017). An investigation of timetable satisfaction factors for a practical university course timetabling problem. 2017 6th International Conference on Electrical Engineering and Informatics (ICEEI) IEEE (2017)

- University Course Timetabling Problem (UCTP) is an educational timetabling problem that deals with the task of assigning educational events (lectures, tutorials, and laboratories) and lecturers to timeslots and classrooms or lab; to generate a weekly schedule. In this work, they have conducted a survey to investigate the satisfaction factors of a course timetable for a Practical University Course Timetabling Problem at Fakulti Teknologi dan Sains Maklumat, Universiti Kebangsaan Malaysia. This paper is organized as follows. Section 1 briefly describes the FTSM-UCTP i.e. Fakulti Teknologi dan Sains Maklumat -University Course Timetabling Problem. Section 2 presents the questionnaires for both lecturers and students, and the result we obtained from this survey. In Section 3, they have discuss the result we gathered from the questionnaires. This survey has clearly

demonstrated three types of schedule patterns based on students and lecturers satisfaction level: the first type is the not-cared patterns which have no influence on the users' satisfaction when these patterns appear in the course timetable. The second type, like in the literature, the penalty pattern, which will decrease the users' satisfaction level when this type of pattern exists in the timetable. The third type of schedule pattern is the reward patterns.

[3] Ilham, N. I., Saat, E. H. M., Rahman, N. H. A., Rahman, F. Y. A., Kasuan, N. (2017). Auto- generate scheduling system based on expert system. 2017 7th IEEE International Conference on Control System, Computing and Engineering (ICCSCE).

- This paper presents an evolutionary algorithm (EA) based approach to solving a heavily constrained university timetabling problem. The approach uses a problem-specific chromosome representation. Heuristics and context-based reasoning have been used for obtaining feasible timetables in a reasonable computing time. An intelligent adaptive mutation scheme has been employed for speeding up the convergence. The comprehensive course timetabling system presented in this paper has been validated, tested and discussed using real world data from a large university. The development of algorithm for timetabling in a large university department is illustrated in this paper by using second year electrical engineering (EE2) cohort as an example. Using following approach they have implemented their paper. Chromosome Representation, Initialization, Generation of initial population, crossover, mutation, evaluation, selection. This paper addresses the Timetabling Problem (TTP), which covers a very broad range of real problems faced continually in educational institutions, and we describe how Evolutionary Algorithms (EAs) can be employed to effectively address arbitrary instances of automated timetabling problem.

[4] Anuja Chowdhary et al, TIMETABLE GENERATION SYSTEM, International Journal of Computer Science and Mobile Computing, Vol.3 Issue.2, February- 2014.

- This project introduces a practical timetabling algorithm capable of taking care of both strong and weak constraints effectively, used in an automated timetabling system. So that each teacher and student can view their timetable once they are finalized for a given semester but they can't edit them. Timetable Generation System generates timetable for each class and teacher, in keeping with the availability calendar of teachers, availability and capacity of physical resources (such as classrooms, laboratories and computer room) and rules applicable at different classes, semesters, teachers and subjects level. In this paper the main component of is to produce the HTML based timetable even / odd semester sheet as the output. In which it takes various inputs from the user such as Teacher List, Course List, Semester List, Room List, Day List and Timeslot as well as various rules, facts and constraints using web based forms, which are stored in XML based knowledge base. This



knowledge base serves as input to our Timetable Generator Algorithm residing on server machine. knowledge base is in the middle, because it is between our timetabling algorithm and GUI front end which is designed in the last. After the representation of KB is standardized, we designed the timetabling algorithm.

[5] Bong Chia Lih, Sze San Nah, Bolhassan, N. A. (2015). A study on heuristic timetabling method for faculty course timetable problem. 2015 9th International Conference on IT in Asia (CITA) IEEE (2015).

- This paper studies university course timetabling problem in a case study related to faculty management system, which is concerned with assigning students/lecturers to classes and time-slots. A two-stage heuristic approach is presented, where the initial stage groups the courses that are able to conduct simultaneously. The second stage then assigns the weekly timeslots for each group of courses, followed by venue for each course. Computational results are presented for the proposed solution using real data. It shows that the proposed solution is effective to handle the faculty course timetabling. A two stage heuristic is proposed to solve this course timetabling case study. This is due to its simplicity to cope with different hard and soft constraints in two stages.

Stage I (Course Grouping) in which all the courses will be divided into a few groups based on the following constraints:

1. Students can max enrol one course in each group.
2. Lecturers can max enrol one course in each group.
3. Takes into account the repeating students to enable them to enrol in certain courses.

Stage II (Timeslot Allocation) in this stage takes into account time-related constraints:

1. One timeslot allocated for only one group.
2. Spread the lecture time for each major/program evenly throughout the weekdays.

## Problem Definition

Timetable generation manually requires time and it's difficult for the person to handle all the constraints that need to be considered. Generally, the hand operated system of time table preparation in colleges is very monotonous and time-consuming which results in either the same teachers ending up with more than one class at a time or a number of classes conflicting at the same classroom. Due to a non-automatic perspective, absolute utilization of resources has proven ineffective.

The solution for the above problems will be handled by the software ,as we will be providing a separate module of validation where all the constraints will be checked for providing an optimal solution and all the constraints will be satisfied by our system. The proposed system is used to generate time table automatically. This ensures the following features:

- Easier slot assigning
- Less time consumption
- No clashes of the resources

## Proposed System Architecture/Working

Proposed system will take the basic inputs such as subjects,classrooms, laboratories,faculties, semester through loadsheets.These inputs will be processed further and the given set of constraints will be applied on it,further it will be validated and the system will check whether all the requirements are fulfilled or not.If all the requirements are fulfilled then only it will go for further processing.After validation,the system will generate the timetable which if approved will be stored in the database.It will provide different views of the timetable like class timetable for the students, laboratory time table for respective laboratories,faculty timetable for respective faculties and master timetable for timetable co-ordinator which can be printed anytime.

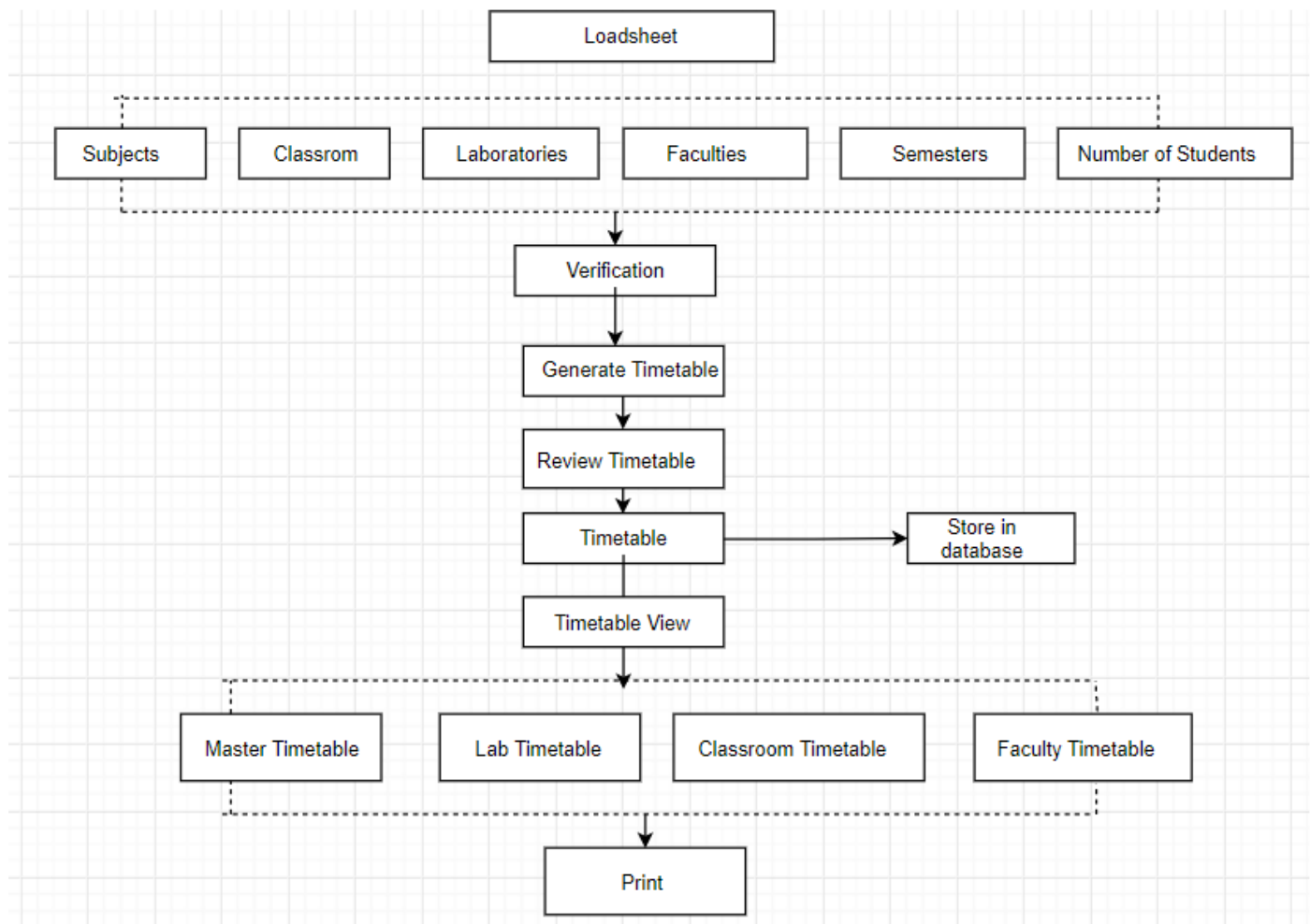


Figure 1: Proposed System

The generated result will fulfill all the required constraints such as:

1. Slots for compulsory subjects should also get assigned properly in order to avoid any kind of conflicts.
2. There are slots which has been allotted for the departmental electives. Elective lecture may be in the classroom or in the laboratory depending upon the requirement of elective.
3. Slots should not overlap likewise if some faculty is teaching in SE then their slot should not be assigned in TE/BE during that particular time.
4. The generated timetable will also take care that each faculty workload should be maximum 10 hours per week for theory and 8 hours per week practical. Faculties assigned with elective Subjects workload 8 hours per week theory.

### Working of Project

As soon as the user opens the system he/she will see the home page where he/she will be asked to upload the load sheet ,there there will be a sample format file which the user can download and modify as per his/her requirement. Once, the user upload the loadsheet he/she will be shown the data of load sheet and will be asked to verify the data, after verification the data will go the algorithm where faculty name will be considered and used to generate the population for Genetic algorithm which will be stored in a array and according to the faculty name another array will be generated having load of that faculty, there will be 3 such pairs for second year, third year and final year respectively.

Once the population will be generated Genetic algorithm will start it's process by selecting any random faculty from array and placing the faculty at random position in time table grid according to the load assigned, this process will continue until all faculties have been assigned for their respective loads. The algorithm will check for clashes while assigning the faculty by checking the positions current status, if it would be free it will assign the faculty there or else go to another position.

In such a way the algorithm will assign all faculties without clashes for all the 3 semesters, once the time table will be generated it will be displayed to the user and if user approves the time table it will be stored in the database and if user doesn't likes the allotment he/she can regenerate the time table and the algorithm will run again and give a new output, user can get n combinations of output using the regenerate button.

The approved and stored time table can be viewed any time.

General Genetic Algorithm steps:

Step 1: Create a random initial state An initial population is created from a random selection of solutions (which are analogous to chromosomes). This is unlike the situation for symbolic AI systems where the initial state in a problem is already given.

Step 2: Evaluate times A value for fitness is assigned to each solution (chromosome) depending on how close it actually is to solving the problem (thus arriving to the answer of the desired problem). (These "solutions" are not to be confused with "answers to the problem; think of them as possible characteristics that the system would employ in order to reach the answer.)

Step 3 : Reproduce (and children mutate) : The chromosomes with a higher fitness value are more likely to reproduce offspring (which can mutate after reproduction). The offspring is a product of the father and mother, whose composition consists of a combination of genes from the two (this process is known as "crossing over").

Step 4: Next generation: If the new generation contains a solution that produces an output that is close enough or equal to the desired answer then the problem has been solved. If this is not the case then the new generation will go through the same process as their parents did. This will continue until a solution is reached.

# Design and Implementation

Each iteration consist of following steps:

1. Selection : The first step consists in selecting individuals for reproduction. This section is done randomly with a probability depending on the relative fitness of the individuals that best ones are often chosen for reproduction rather than the poor ones.
2. Reproduction : In the second step, offspring are bred by selected individual, For generating new chromosomes, the algorithm can use both recombination and mutation.
3. Evaluation : Then the fitness of the new chromosomes is evaluated.
4. Replacement : During the last step individuals from the old population are killed and replaced by he new ones.

The algorithm is stopped when the population converges toward the optimal solution:

```
BEGIN /*genetic algorithm*/
```

```
Generate initial population;
```

```
Compute fitness of each individual;
```

```
WHILE NOT finished DO LOOP
```

```
BEGIN
```

```
Select individuals from old generations
```

```
For mating;
```

```
Create offspring by applying
```

```
recombination and/or mutation
```

```
to the selected individuals;
```

```
Compute fitness of the view individuals;
```

Kill old individuals to make room for  
new chromosomes and insert  
offspring in the new generalization;  
IF Population has converged  
THEN finishes:= TRUE;  
END  
END

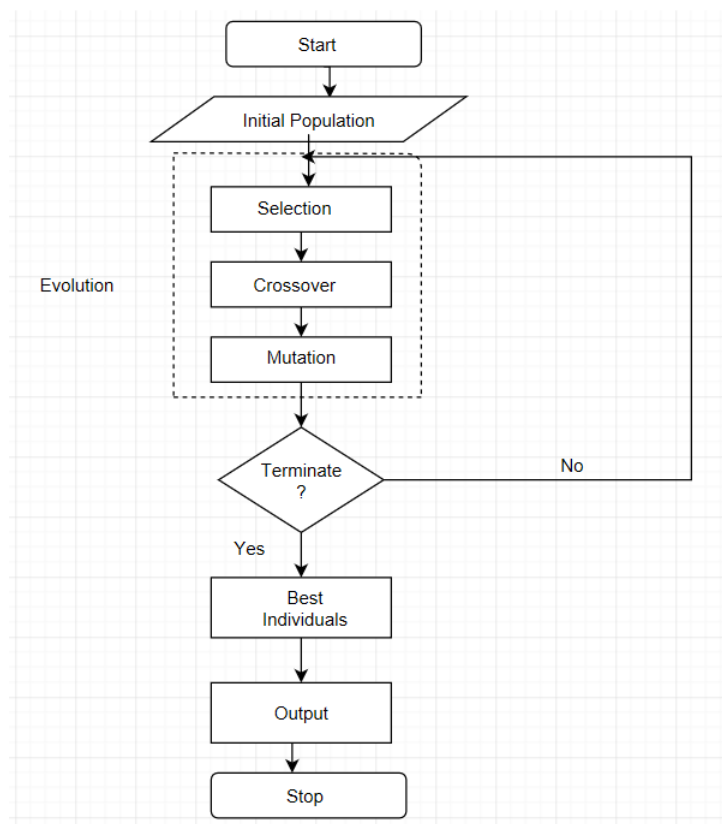


Figure 2: Flowchart of Genetic Algorithm

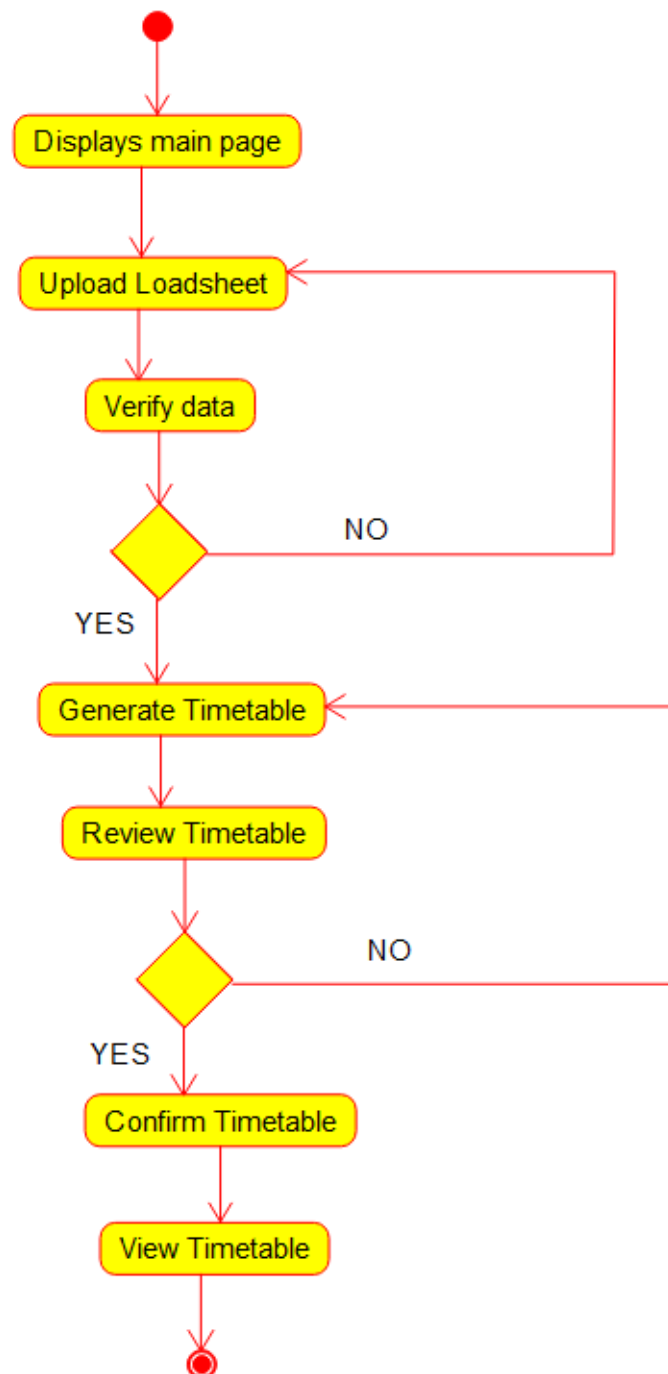


Figure 3: Activity Diagram



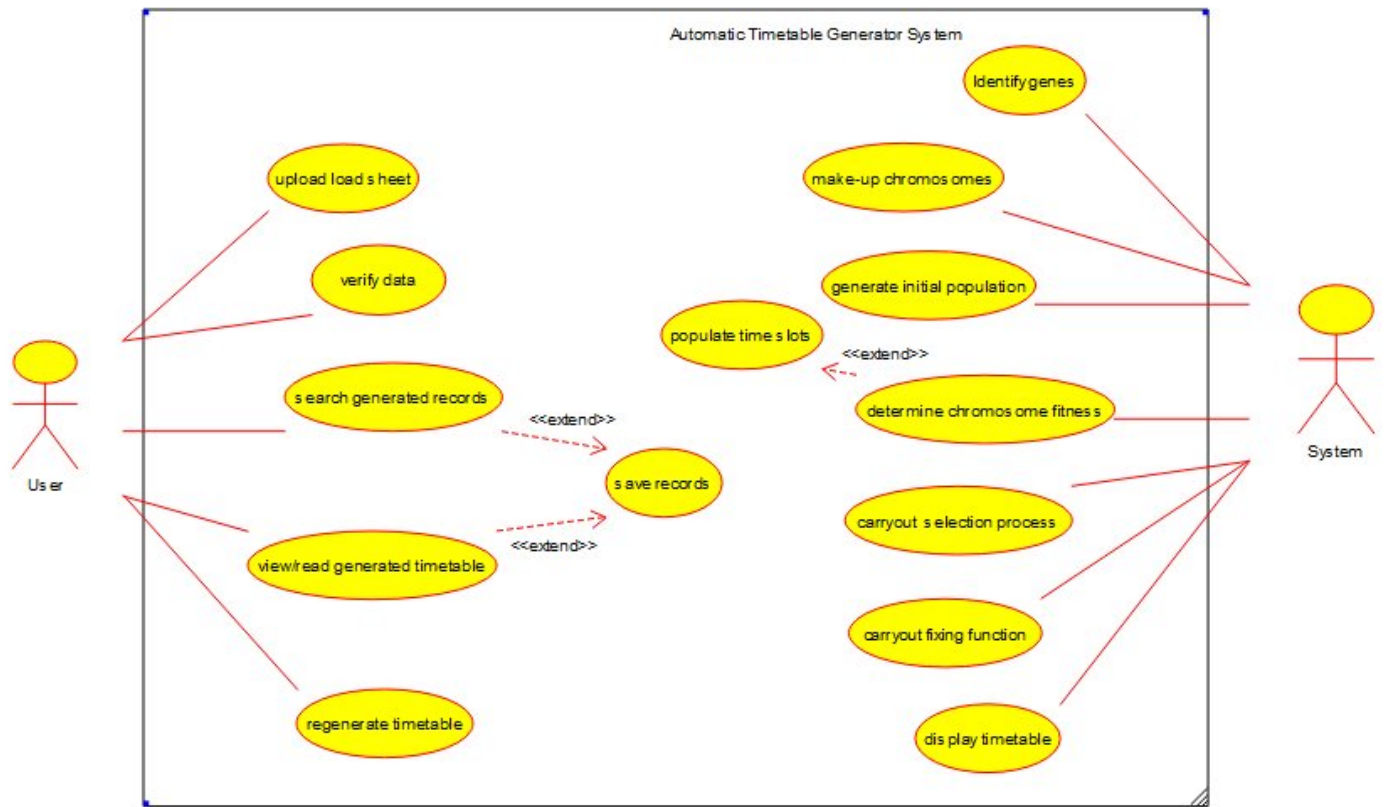


Figure 4: Usecase Diagram

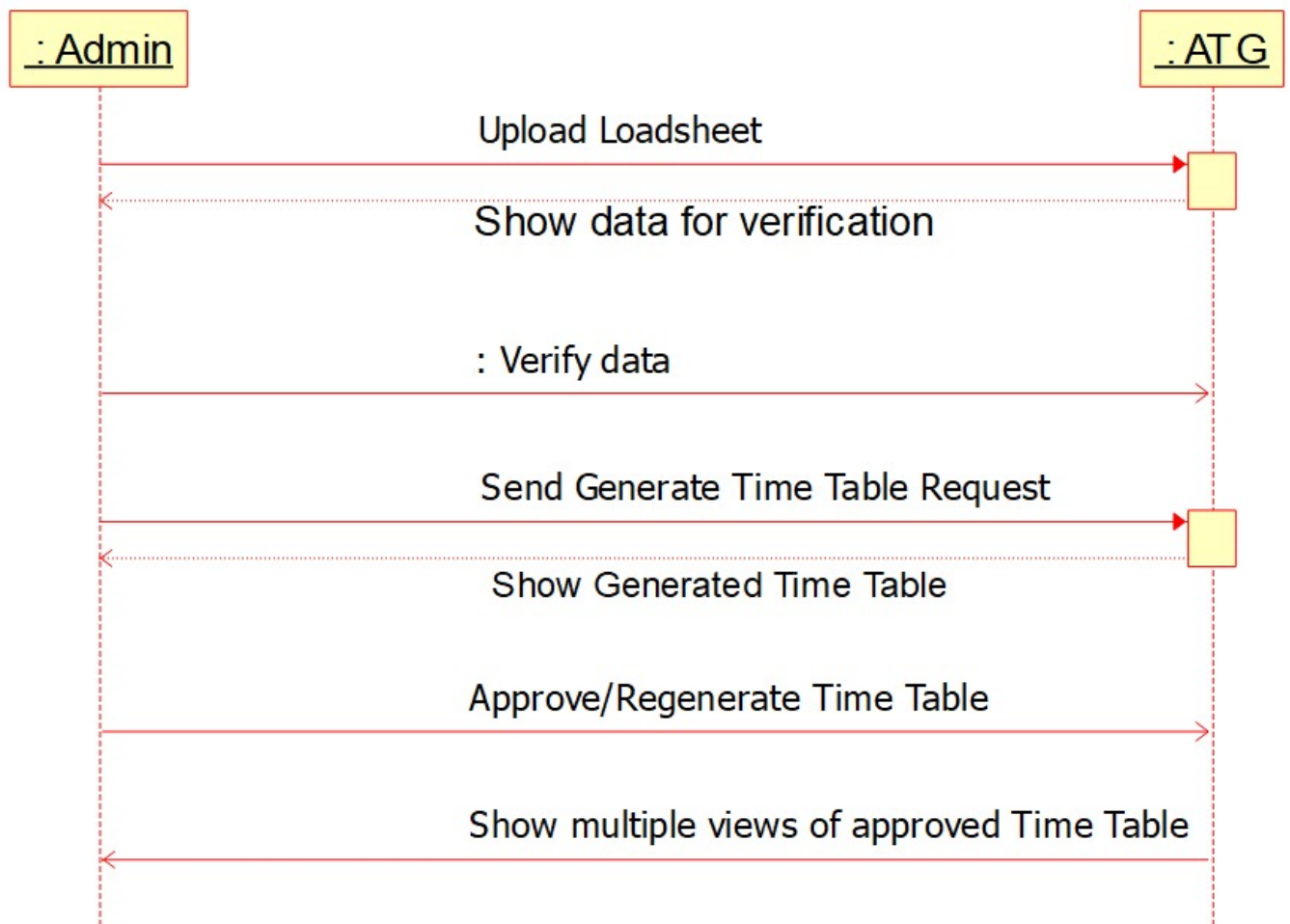


Figure 5: Sequence Diagram

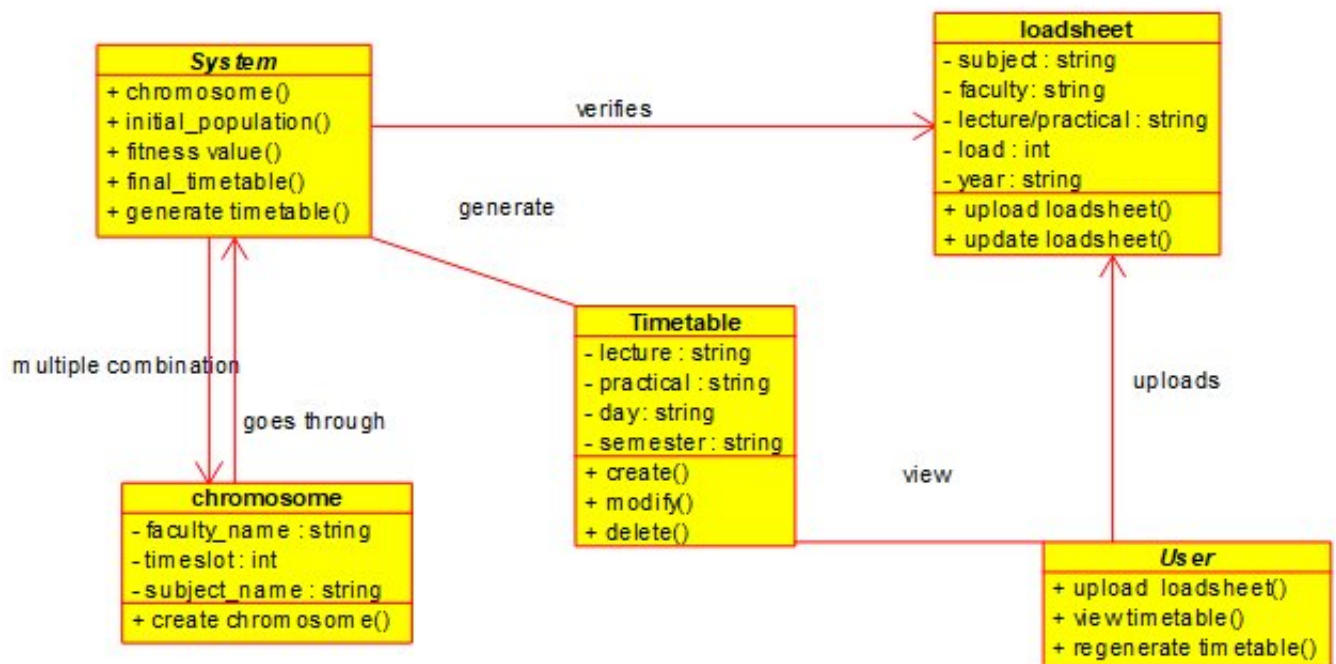


Figure 6: Class Diagram

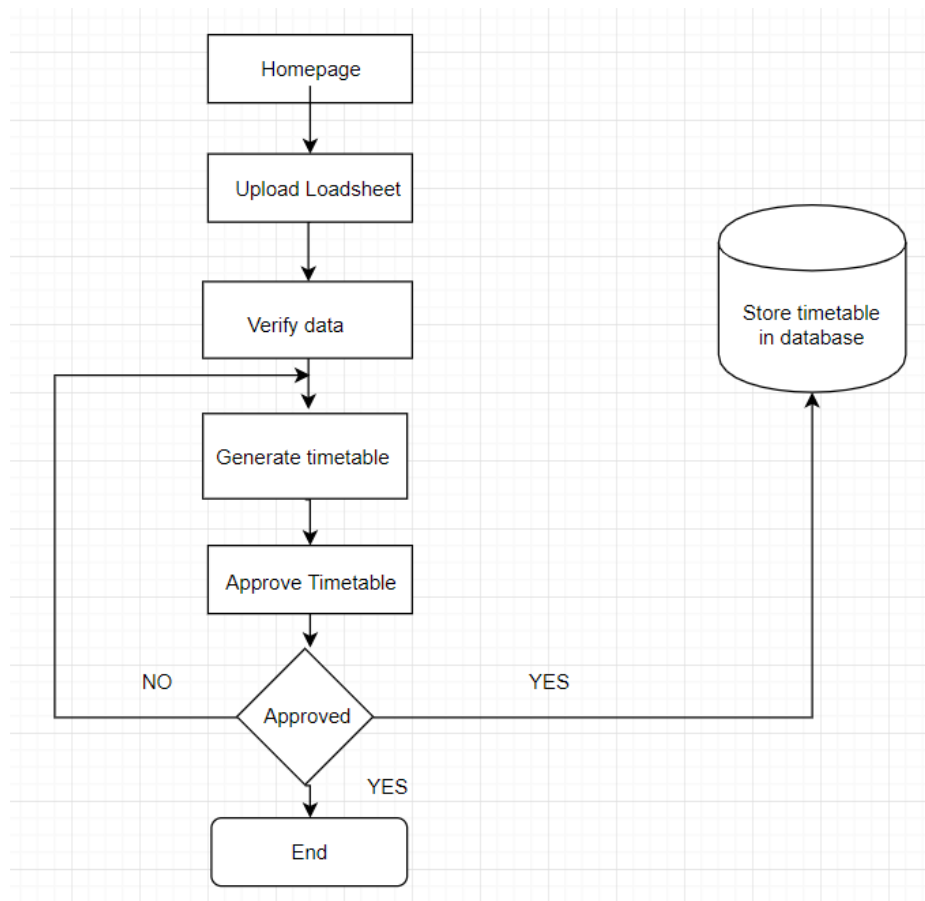


Figure 7: Architecture Diagram

# Summary

The work presented in this report is related to Automatic Timetable Generator Using Genetic Algorithm.

- Automatic time table generator: A system that enables user to create time on few clicks instead of working for hours manually to generate a timetable.
- Genetic Algorithm: Algorithm that works at the back end to generate optimal outcome, it also helps in satisfying user defined constraints.

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<https://ieeexplore.ieee.org/document/7349832>