Shivgram Education Society's

SHREE RAYESHWAR INSTITUTE OF ENGINEERING & INFORMATION TECHNOLOGY

SHIRODA,GOA 403 103

DEPARTMENT OF INFORMATION TECHNOLOGY ENGINEERING

2019 - 2020

Empowerment through Technology

"AUTOMATED TIMETABLE GENERATION"

by

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under the guidance of

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BACHELOR OF ENGINEERING : GOA UNIVERSITY

Empowerment through Technology

CERTIFICATE

This is to certify that this dissertation entitled

"AUTOMATED TIMETABLE GENERATION"

submitted in partial fulfillment of the requirements for Bachelor's Degree in Information Technology Engineering of Goa University is the bonafide work of

Ms.Ila Dhond
Ms.Shivani Pednekar
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Mrs. PRAJAKTA TANKSALI   **Mrs.MANJUSHA SANKE**
Internal Guide   **Head Of The Department**
(Assistant Professor)

_____
PRINCIPAL

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DATE:————————   EXAMINER 1:————————

PLACE:————————   EXAMINER 2:————————

Abstract

Manual system of planning and generating the timetable with large number of subjects is time consuming, complex, and ends up with clashes. Time management and reducing eorts to yield better and optimal solution has been primary goal of mankind. Creating timetable is a tedious process. Timetable is needed in institutions to organize and conduct lectures, manage breaks, and transport schedule. This was the motivation behind us or choosing the project 'Automated timetable generation'.

Our software basically aims at automatically generating timetable for faculty and students. A master timetable will also be generated. Faulties will be allocated dierent subjects and lecture will be conducted according to university guidelines. Classrooms and labs will be assigned for lectures. The workload will be equally divided amongst faculties. Our software will generate the timetable automatically thus saving the eorts and time of the faculty. Genetic algorithm is being used generate the timetable. Genetic algorithm yields faster and more accurate result. Apart from this it will be free from human errors. Over here the super Admin that is the Principal will register the Admin that is the Hod of dierent department. Faculties will be mapped with their respective subject and will be assigned the lectures considering the fact that no faculty has continuous 3 hr lecture. The time slot will be allotted and the workload will be equally divided. In case any faculty is absent then he/she will be replaced with a substitute faculty and a temporary timetable for that day will be generated.

Acknowledgement

An Endeavor over a period of time can be successful only with the constant support and guidance from our well-wishers, hence we take this opportunity to express our gratitude to all those who encouraged us in getting a head start on our project work.

We are immensely grateful to our Principal, for providing the needed facilities creating a comfortable environment required for the project.

We also thank **Mrs.Manjusha Sanke**, Head of the Department of Information Technology who assured us every support from the institute.

Our sincere gratitude to our Internal guide, **Mrs.Prajakta Tanksali** Assistant Professor,Project guide and the Project coordinator, IT Department, for providing us with excellent guidance, direction and constant support in organization, planning and scheduling the project phases.

Besides we are also grateful to our friends and well-wishers who provided us with lots of support.

Lastly, we are grateful to whole of the Information Technology staff for providing us with the lab facilities and co-operation for our project.

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Chapter 1

Introduction

1.1   Introduction to Project

Currently timetable is generated manually which is complex and tedious job so our project Automatic timetable generation is meant for generating automatic timetable that will save time and human eorts. Our aim here is to develop a simple, user friendly and efficient application which could automatically generate good quality timetables within seconds. It is a Java based software
The timetable schedules the faculty at provided time slots in such a way their timings do not overlap and timetable schedule makes best allotment of all faculty subject demand. There have been numeric approaches made earlier in the difficulty of constructing timetables for colleges and schools. Timetabling problems may be solved by diverse methods from operation study such as graph coloring, local search measures such as taboo search, simulated annealing, genetic algorithms or even from backtracking based constraint fulfillment handling. This problem is formulated as a constraint satisfaction problem and we discuss the various approaches that are capable of handling both hard and soft constraints. It is a complete timetable solution for colleges which help to overcome the challenges in constructing the timetable manually.

1.2   Purpose of the Project

The main purpose of the project is to automatically generate a timetable by taking faculty , subject details, workload of faculty, time slots as input and generate timetable by satisfying all the constraints. It is a comprehensive solution for colleges which help to overcome the challenges in current manual system. The timetable schedules the faculty at provided time slots in such a way their timings do not overlap and timetable schedule makes best allotment of all faculty subject demand. It will also manage timetable when any faculty is absent with the substitute faculty.Our project will generate class wise, faculty wise and master timetable automatically.

1.3 Problem definition

1.3.1 Existing System

The class timetable problem is a typical scheduling problem that appears to be a tedious job in every academic institution once or twice a year. Timetable scheduling is done manually with a single person or group which consumes a lot of time. The problem with doing it manually is that as the number of variable increases the complexity and difficulty of the task grows exponentially. It becomes difficult and time consuming as person has to remember and manage all the constraints. Planning timetable is one time consuming and error prone application.The existing system of manual generation of timetable is generating timetable manually by human eorts. It is paper based process and takes lots of time in generating timetable. Maintaining workload for faculty with this scheduling is difficult to handle. With this type of scheduling there is possibility of clashes with the lecture timings. So manual timetable generation will be more complex.

1.3.2 Proposed System

In order to overcome the said problem we have proposed Automatic timetable generation system which will generate timetable automatically and save a lot of time and human eorts. In this system no paperwork is not required, there will be no error and confusion. The proposed system be user friendly and have smooth integration. There will be no clashes in lecture time slots and workload of the faculty will be maintained.

The system proposed by us is implemented using java and oracle database. The Principal of the institute registers the faculties along with their designation. The subjects per semester is entered and then using the algorithm they are mapped with the faculty. Genetic algorithm is being implemented in general to map and to generate the timetable. Genetic Algorithm yields more accurate and quick results.

The timetable generator will consist of input module, and as output timetable will be generated

A. Input Data
The input data module can be described by a type of data given, the data contains:

• Subject: which describe the name of the subjects belonging to a particular semester and year.This will also include the maximum lectures,tutorials and practicals of the particular subject as prescribed by the university.
• Faculty: which describe the name of the faculty along with their specialization.
• Workload: it is the amount of work imposed per faculty

B. Constraints :
Constraints can be divided into 3 parts:
• Validity violation constraints

- Hard constraints
- Soft constraints

1) Validity violation constraints: These are the constraints which are needed to be followed:
- There are certain lecturers that may be assigned at the same time in more than one class.
- Two faculties cannot be assigned to the same class simultaneously.
- The substitution should be done considering the timetable of the substitute.

2) Hard constraints: Hard constraints are the ones which is Mandatory
- One cannot conduct two different lectures in the same class at a given time
- Scheduling of the classes and labs must be fixed

3) Soft constraints: These are the constraints that are not compulsory but still demanding. They are not to be really satisfied but the solutions are generally considered good if large numbers of them are taken care of.
- No lecture of the same subject should be conducted more than twice in a day
- Lecturers cannot be assigned continuous classes
- Timings must be strictly followed
- Time slot distribution must be optimal

C. Modules
The block diagram represents the schematic form of general arrangement of the processes of the system. It consists of the following:

- INSERTION MODULE
In this module faculty details, subject details, workload per faculty and time slots of lecture is being inserted by the admin.

- MAPPING MODULE
In this module admin maps the subject to semester, faculty to subject and then faculty-subject data to classroom.

- ALLOCATION MODULE
In this module genetic algorithm is used to allocate the mapped faculty-subject and classroom data to time slots and generate the timetable.In case if any faculty is absent then it takes the details of the absent faculty and the substitute faculty, day and date of leave of the absent faculty from the substitution module and performs the changes and generates the timetable.

- SUBSTITUTION MODULE
This module functions only if any faculty is absent. The admin provides the absent faculty id, substitute faulty id, day and date on which the particular faculty is absent to the allocation module.

- DISPLAY TIMETABLE MODULE
This module display class wise, faculty wise and master timetable.

1.4   Scope of the Project

Timetable Generation System generates timetable for each class and teacher, considering availability of teachers, and resources (such as classrooms, computer rooms). Maximum and minimum workload for a faculty for a day, week and month will be maintained for efficient generation of timetable.Best of all, this Timetable Generation System tremendously improves resource utilization and optimization. Timetable generation system is user friendly and economic for educational institutes.

1.5   Report organization

The current introductory section provides an overall picture of what has been completed till date and brief introduction about each chapter.

1. Chapter 1: INTRODUCTION
   This section focuses on the purpose and scope of our project An Improved Gaming Approach Using Artificial Intelligence.

2. Chapter 2: LITERATURE SURVEY
   This section describes the concepts and the research performed on the existing projects /models

3. Chapter 3: SOFTWARE REQUIREMENT SPECIFICATION
   This section provides us with the information about specific requirements of the proposed system.

4. Chapter 4: DESIGN
   This section includes the software lifecycle model (Incremental model), which will be used in developing the software.

5. Chapter 5: IMPLEMENTATION
   This section deals with the implementation of the various modules of the project.

6. Chapter 6: CONCLUSION AND FUTURE SCOPE
   This section deals with the completion of the modules and the future scope of the project.

Chapter 2

Literature Survey

In our survey on 10 International papers we found out many algorithms for automatic generation of timetable like Genetic algorithm , Tabu Search, Simulated Annealing, Evolutionary algorithm out of which we found Genetic algorithm as the best algorithm for giving the optimal solution and automatic generation of timetable. It can handle large amount of data and give the best optimal solution in less amount of time.

No	Name of Paper	Publisher / Year	Author	References		
1)	Automatic Timetable Generation	International Journal of Advanced Research in Computer Science and Software Engineering Volume 7, Issue 5, May 2017 IJARCSSE	Saritha M, Pranav Kiran Vaze, Pradeep, Mahesh N R	http://ijarcsse.com/Before_August_2017/docs/papers/Volume_7/5_May2017/SV7I5-0234.pdf	**Objective**	Finding of best solution by combining all the algorithms.
					Algorithm	Genetic, Evolutionary, mimetic hybrid algorithm, genetic artificial immune network (GAIN)
					Tools and technologies	• Frontend: JavaFx • Backend: MySQL
					Support	Windows 7 and above
					Advantages	• Generates timetable automatically • Saves time, • Colleges will be able to overcome the challenges in current system
2)	Automatic Timetable Generation System	JETIR1504029 Journal of Emerging Technologies and Innovative Research (JETIR) April 2015, Volume 2, Issue 4	Deeksha C S, A Kavya Reddy, Nagambika A, Akash Castelino, K Panimozhi	http://www.jetir.org/papers/JETIR1504029.pdf	**Objective**	Searching for best solution.
					Algorithm	Genetic algorithm, Tabu Search, Greedy Random Adaptive Search
					Tools and technologies	Not mentioned
					Support	Not mentioned
					Advantages	• Provides diverse values of solutions and reaches global maxima • Gives good results in a few cases in practical run times • Results are executed faster

3)	Automated college timetable generator	International Journal of Scientific & Engineering Research Volume 9, Issue 4, April-2018	Adithya R Pai, Ashwitha S, Raksha Shetty, Prof. Geethalaxmi	https://www.ijser.org/researchpaper/Automated-college-timetable-generator.pdf	**Objective**	Feasibility of generating college timetable.
					Algorithm	Genetic Algorithms (GAs), Evolutionary Algorithms (EAs), mimetic hybrid algorithm, Genetic Artificial Immune Network (GAIN)
					Tools and technologies	• Frontend: Java, HTML, CSS, Net Beans. • Backend: MySQL • Web server: Glass fish
					Support	Operating system: Windows 7/8/10
					Advantages	• Information is available at one place • User friendly • Saving of time • faster and better generation of timetable
4)	A STUDY ON AUTOMATIC TIMETABLE GENERATOR	INTERNATIONAL JOURNAL OF SCIENCE AND INNOVATIVE ENGINEERING & TECHNOLOGY MAY 2018 ISSUE VOLUME 5 ISBN No. 978-81-923607-3-7	Akshay puttaswamy, H M Arshad Ali Khan, Chandan S.V, Parkavi. A	https://www.researchgate.net/publication/326265336_A_STUDY_ON_AUTOMATIC_TIMETABLE_GENERATOR	**Objective**	Realistic timetable algorithm was proposed which was capable of taking care of both hard and Soft constraints.
					Algorithm	The Local Search Procedures: • Simulated Annealing • Tabu Search • Genetic Algorithms
					Tools and technologies	Not mentioned
					Support	Not mentioned
					Advantages	Faster and better generation of timetable.

5)	International Journal of Computer Science and Mobile Computing	IJCSMC, Vol.3, Issue.2, February 2014, pg.410–414 -	Anuja Chowdhary[1], Priyanka Kakde[2], Shruti Dhoke[3], Sonali Ingle[4], Rupal Rushiya[5], Dinesh Gawande[6]	https://ijcsmc.com/docs/papers/February2014/V3I2201474.pdf	**Objective**	Proposing a mathematical model through analysis and summarization of existing problem
					Algorithm	Genetic Algorithms (GAs), Evolutionary Algorithms (EAs)
					Tools and technologies	HTML,XML
					Support	Not mentioned
					Advantages	• Easier slot assigning • Less time consumption • No slot clashes • Always considers the other department slots first • Various possible slot combinations can be acquired • User friendly
6)	Time Table Generation using Constraint Programming Approach	International Journal on Future Revolution in Computer Science & Communication Engineering ISSN: 2454-4248 Volume: 4 Issue: 3 269 – 272	Yamini Kutumbale, Archana Magare	https://www.slideshare.net/RahulSharma3399/time-table-generation-using-constraint-programming-approach	**Objective**	A local search procedure is applied to the new solution to maximize its fitness value
					Algorithm	Local Search Algorithm using weighted sum of multiple objectives
					Tools and technologies	Not Mentioned
					Support	Windows 7 and above
					Advantages	This algorithm gives an efficient mechanism for the creation of efficient search strategies.

7)	Automatic Timetable Generation using Genetic Algorithm.	International Journal of Scientific & Engineering Research Volume 9, Issue 4, April-2018 19 ISSN 2229-5518	Shraddha Shinde, SaraswatiGurav, Snehakarme	https://www.ijser.org/researchpaper/Automatic-Timetable-Generation-using-Genetic-Algorithm.pdf	**Objective**	The implementation of a computer program which employs Genetic Algorithm (GAs) in the quest for an optimal lecture timetable generator.
					Algorithm	Genetic algorithm
					Tools and technologies	programming language: JSP Backend: MYSQL
					Support	Windows 7 and above
					Advantages	- Technically feasible - User friendly - New models can be added later on the application - All tools used are free and open source
8)	Automatic Time-Table Generation System using Genetic Algorithm	International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 3, March 2016	Amey Salvi, Omkar Khanvilkar, B.W. Balkhande	https://www.ijarcce.com/upload/2016/march-16/IJARCCE%20197.pdf	**Objective**	The system would serve as an ideal platform for less strenuous work by providing the administrator with an interactive interface for the time-table generation for all courses and departments.
					Algorithm	Genetic Algorithm, Time-table Scheduling
					Tools and technologies	2SESDK, MySQL and Tomcat Apache. Java Platform Standard Edition (Java SE)
					Support	Windows 7 and above
					Advantages	- A compatible and precise timetable - Organized and reliable. - Allocation of periods is completelyautomated

9)	Automatic Timetable Generation using Genetic Algorithm	International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 2, February 2015	Dipesh Mittal, Hiral Doshi, Mohammed Sunasra, Renuka Nagpure	https://www.academia.edu/35710223/Automatic_Timetable_Generation_using_Genetic_Algorithm.	**Objective**	The implementation of a computer program which employs Genetic Algorithm helps in generating timetable.
					Algorithm	Genetic algorithm
					Tools and technologies	C# along with .NET
					Support	Windows 7 and above
					Advantages	• Faster and better generation of timetable
10)	A Novel Approach for Automatic Timetable Generation	International Journal of Computer Applications (0975 – 8887) Volume 127 – No.10, October 2015	Mayuri R. Bagul, Sunil C. Chaudhari, Sunita N. Nagare, Pushkar R. Patil, K.S. Kumavat	http://data.conferenceworld.in/ICETEMR/P174-184.pdf	**Objective**	An automated system with computer assisted timetable generator.
					Algorithm	• Heuristic Algorithm • Resource Scheduling Algorithm
					Tools and technologies	Not mentioned
					Support	Not mentioned
					Advantages	• Efficient generation of timetable • User friendly

2.1   TechnologiesUsed

2.1.1   Netbeans 8.2

NetBeans is open souce and integrated development environment (IDE) for Java. NetBeans runs on Windows, macOS, Linux and Solaris. NetBeans is also referred to as a platform of modular components used for developing Java desktop applications. It is the smarter and faster way to code. The application provides robust code analyzers, converters, and editors that display support for the latest Java technologies. The features allow developers to quickly and eortlessly upgrade applications to use the cutting-edge Java 8 language constructs.

2.1.2   Oracle database

Oracle Database (referred to as Oracle RDBMS or simply as Oracle) is a proprietary multi-model database[4] management system produced and marketed by Oracle Corporation. It is a database commonly used for running online transaction processing (OLTP), data warehousing (DW) and mixed (OLTP DW) database workloads.We are using Oracle 11g releaseed in February 2019. ur project we are using Netbeans 8.2 as the frontend as we are developing a java based software and database as Oracle 11g as it can handle complex data structure smoothly.Genetic algorithm will play a key role in our project.

Chapter 3

Software Requirement Specification

3.1 Introduction

3.1.1 Purpose

Most educational institutions prefer manual methodologies in generation of their timetables which takes ample amount of time to complete and be optimal.Here we aim to develop a simple, clear-cut, efficient and a portable application, which will automatically generate optimal and efficient timetable within a low span of time. The main purpose of the project is to automatically generate a timetable by taking faculty and subject details as input and generate the timetable by satisfying all the constraints for the educational institute which will save time and reduce human efforts. The timetable schedules the faculty at provided time slots in such a way that their timings do not overlap and the timetable schedule makes best allotment of all faculty subject demands assisting to manage timetable when any faculty is absent with the substitute faculty.

3.1.2 Intended Audience and Reading Suggestions

Intended Audience of the project comprises of :

- Principal:Creates the timetable by inserting the faculty and subject details and maps the faculty to respective subject of the semester, and performs the modification of the timetable whenever and wherever needed.

- Faculty:Views the generated timetable.

- Students:Views the generated timetable.

3.1.3   Product Scope

Automatic Timetable Generation System generates timetable for each class and teacher considering availability of teachers and resources (such as classrooms, laboratories and computer rooms). Best of all, this Timetable Generation System tremendously improves resource utilization and optimization such as replacing the absentee with a substitute faculty. Efficient generation of timetable will be maintained for a faculty by considering the workload for a day, week and month. When selecting a faculty as substitute it will ensure that the substitute faculty is free at that particular time slot and allocate the faculty as substitute. Timetable generation system is user friendly and economic for educational institutes.

3.1.4   References

[1] Sarithaetal., International Journal of Advanced Research in Computer Science and Software Engineering 7(5), May- 2017, pp. 204-211

[2] International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 2, February 2015 Gelowitz

[3] International Journal of Scientific Engineering Research Volume 9, Issue 4, April-2018

[4] Anuja Chowdharyetal, International Journal of Computer Science and Mobile Computing, Vol.3 Issue.2, February- 2014, pg. 410-414

[5] International Research Journal of Engineering and Technology (IRJET) Volume: 06 Issue: 02 — Feb 2019

[6] IJIRST –International Journal for Innovative Research in Science Technology Volume 1 — Issue 11 — April 2015

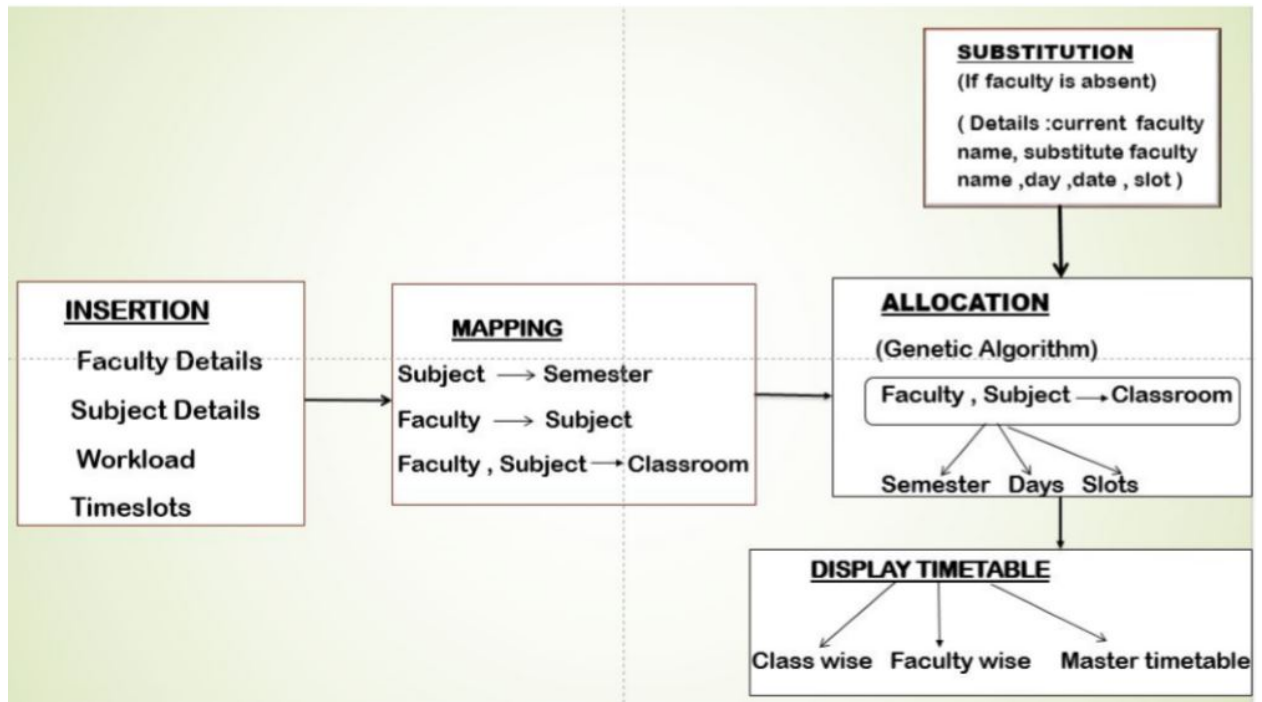## 3.2 Overall Description

3.2.1 Product Perspective

Figure 3.1: block diagram

3.2.2 Product Functions

The developed software will possesses following Functionality. Some of the Major functionalities are mentioned below:

- Generates multiple Timetables for miscellaneous semesters and streams.

- Generates Timetable as per class and availability of faculty.

- Information Storing in Database.

- Vanquishes human errors.

- Diminishes human efforts.

- Systematic planning of lectures.

- Systematic managing of faculty and resources such as labs, classrooms.

- Assigning substitute faculty for absent faculty.

- Classification of data on single site

- Implements an user interface on the system

- User friendly front-end design

- Strong authentication while performing various operations

3.2.3 User Classes and Characteristics

- Administrator activities:
  -Takes input as faculty and subject details.
  -Maps faculty with their respective subjects.
  -Replaces absentee with substitute faculty.
  -Performs modification of the timetable.
  -Authorized to manage the database.
  -Performs viewing and managing of the timetable.

- Faculty activities:
  -Views the generated timetable.
  -Views own scheduled timetable.

- Student activities:
  -Views the timetable as per the subjects.
  -Hold no right to implement direct modification of the timetable.

3.2.4 Operating Environment

The software will run efficiently on windows 7 and above versions.

3.2.5 Design and Implementation Constraints

- A classroom is not assigned to more than one faculty at a time.

- A faculty cannot teach more than one class at a time.

- Every subject hours and practical sessions must be allotted for the week.

- Lecture duration must be distributed among the faculties accordingly.

- Lunch break should be allocated on the same time.

- Faculties must not be allotted for the same time slots.

3.2.6   User Documentation

User manual consisting of the steps will be provided to a new user(admin) for guidance to automatically generate the timetable.

3.3   External Interface Requirements

3.3.1   User Interfaces

The user intends to view the Time Table that is, it can be a student, a faculty and the Head of the Department. Multiple users can connect through the software for viewing the time table.

- Admin:
  -Uses the Software to generate the Time-Table according to the needs and specific requirements of the class, faculty for which the time table needs to be generated.
  -Inserts input as details of faculty and subject.
  -Maps faculty with respective subject of the semester.
  -Replaces absentee with substitute faculty.
  -Performs modification of the timetable.
  -Manages and views the timetable.

- Faculty:
  -Logs in to the system to view his/her timetable.

- Student:
  -Directly view the timetable of their class for the respective semester.

3.3.2   Software Interfaces

Automatic Timetable Generator is a JAVA based software used to generate timetable automatically. Currently timetable is managed manually. Also, time-slots will be managed automatically. The software will be built using JAVA programming language. The Oracle database will be utilized. The system will be supported by windows 7 and/or higher versions.

3.4 System Features

- The system provides automated generated timetable according to class and faculty.

- The admin inserts the faculty and subject details along with mapping of each faculty to the respective subject.

- The admin can replace the absentee with the substitute faculty.

- System provides authentication and encryption.

- System schedules the faculty at provided time-slots in such a way that their timings do not overlap and the timetable scheduling makes best allotment of all faculty subject demands.

- Subject and practical hours will be maintained by the system per week.

- System will maintain considerable workload for a faculty for a day, week and month.

- System provides resource utilization and optimization and accurate generation of the timetable.

3.5 System Features

3.5.1 Description and Priority

The Automated Timetable Generation System maintains information about subject details such as subject name, semester, department; faculty details such as faculty name, faculty id, password, the time-slots assigned to each subject, the classrooms allocated.
The Timetable Generation System is of high priority as the system allows the admin to easily create a unique timetable for each class and faculty.

3.5.2 Stimulus/Response Sequences

Interface for Input:
The system will be having an easy to use and interactive interface to enter all the inputs like faculty details, subject details and mapping of faculty to respective subjects.

Database Capabilities:
The system will have well-designed database to store all the information which will be entered as the input. Separate database maintaining basic information, subjects, teachers, their associations and other details of database for holding generated timetable and for storing required time-tables.

Processing Capabilities:
The system will consist of algorithm to process all the data present in the database taken into account the numerous constraints such as the class is not assigned to more than one faculty at a time. The faculty can not conduct more than one class at a time. Every subject hours and practical sessions must be adjusted for the week. Faculties must get equal hours of lectures in a week. Lunch break must be allocated accordingly.

3.5.3 Functional Requirements

The set of requirements for Automated Timetable Generation were developed based on two sources: information requirements set forth by the university/college and the transit Web Guidelines.

Header fields that are associated with number of days in a week, time-slots etc. Subjects that can be categorized by number of hours in a week.

Other features supported by time-table generation is substitution of faculty in place of absentee on any following days of the week.

3.6 Other Nonfunctional Requirements

3.6.1 Performance Requirements

The end output generated will be the timetable for admin, faculty and students.

3.6.2 Security Requirements

- Password of the admin should be encrypted.

- The system is authorized.

Chapter 4

Design

Design is an early phase of the project where a project's key features, structure, criteria for success and major deliverable are all planned out.

4.1 SOFTWARE DEVELOPMENT MODEL

Incremental Model
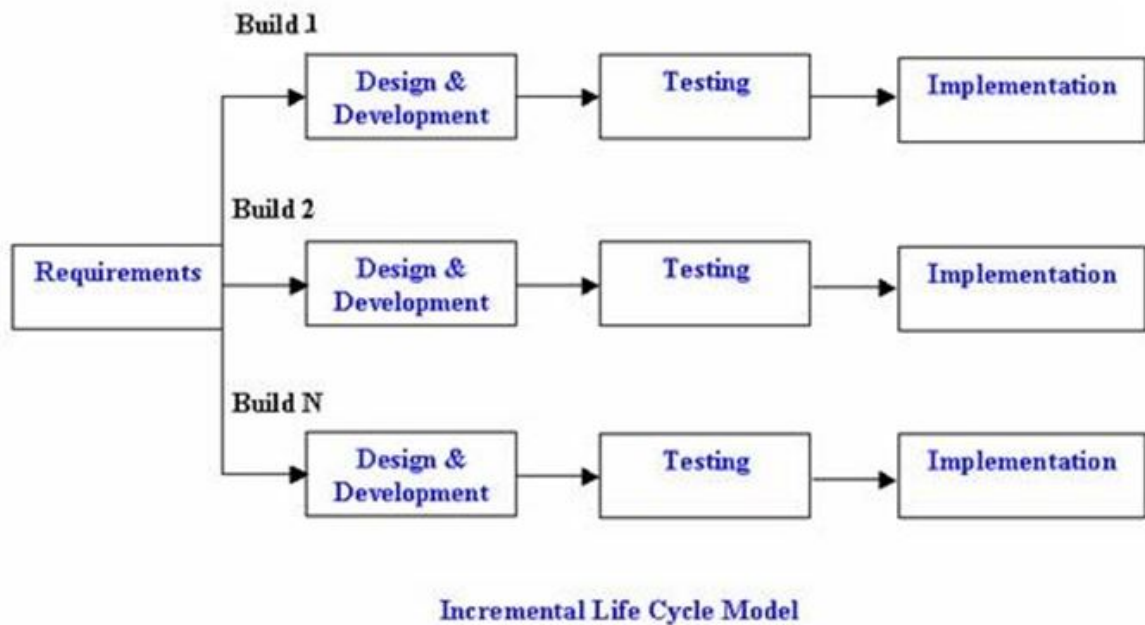
Figure 4.1: Incremental Model

The Software development models are the various processes or methodologies that are being selected for the development of the project depending on the project's aims and goals.In the Iterative model, iterative process initiates with a simple implementation of a small set of the software requirements and iteratively enhances

the evolving versions until the entire system is implemented and ready to be deployed. An iterative life cycle model does not attempt to start with a complete specification of requirements. Instead, development begins by specifying and implementing just a part of the software, which is then reviewed to identify further requirements.

This process is then repeated, creating a new version of the software at the end of each iteration of the software model. Iterative and incremental development is a combined product of both iterative design or iterative method and incremental build model for development. During software development, more than one iteration of the software development cycle may be in progress at the same time.

This process may be described as an "Evolutionary Acquisition" or "Incremental Build Approach." In this incremental model, the entire requirement is divided into various builds. During each and every iteration, the development module goes through the requirements, design, implementation and testing phases. Each subsequent release of the module adds function to the previous release. The process continues till the entire system is ready as per the requirement.

4.2 SYSTEM DESIGN

4.2.1 BLOCK DIAGRAM
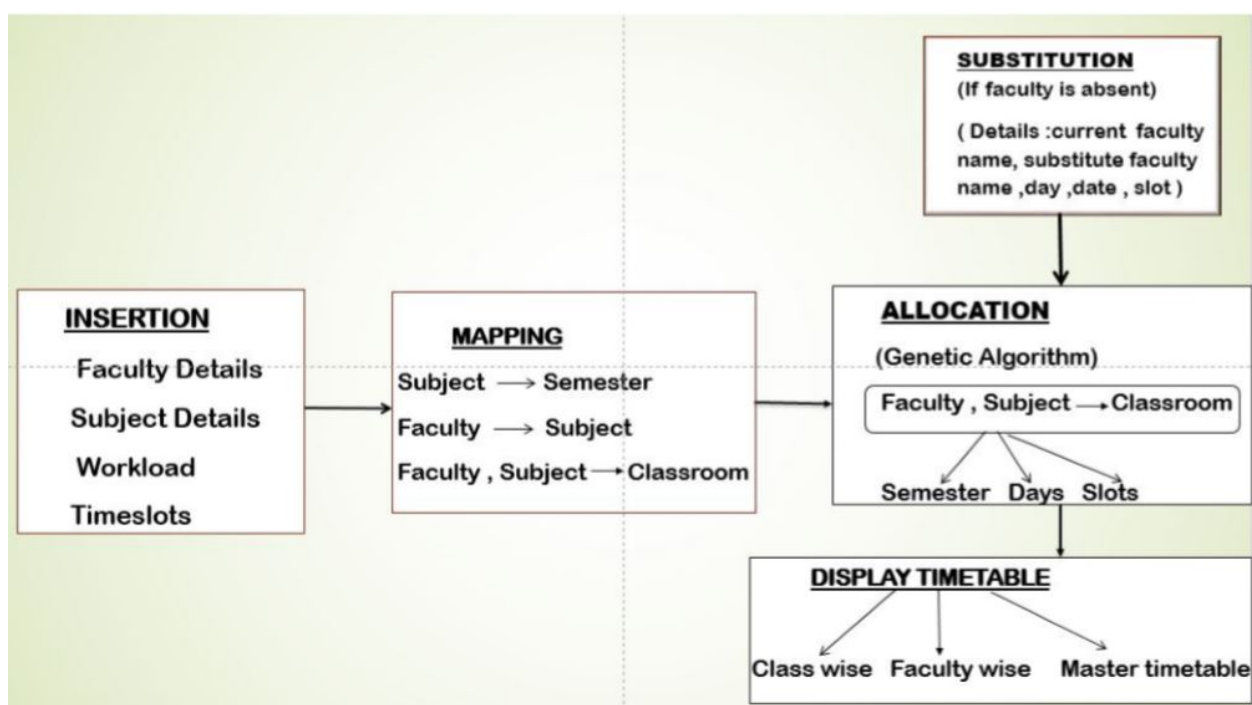
Figure 4.2: Block Diagram

The block diagram represents a diagram showing the schematic form of the general arrangement of the processes of the system. It consists of :

INSERTION MODULE In this module the Admin inserts faculty details, subject details, workload of faculty and time slots of lecture.

MAPPING MODULE In this module admin maps subject to semester, faculty to subject and then maps faculty subject data to classroom.

ALLOCATION MODULE In this module we are using genetic algorithm to allocate the mapped faculty-subject and classroom data to time slots and generate the timetable. In case if any faculty is absent then it takes the details of the absent faculty and the substitute faculty, day and date of leave of the absent faculty from the substitution module and performs the changes and generates the timetable.

SUBSTITUTION MODULE This module functions only if any faculty is absent. The admin provides the absent faculty name, substitute faulty name, day and date on which the particular faculty is absent to the allocation module.

DISPLAY TIMETABLE MODULE This module display class wise, faculty wise and master timetable.

4.2.2 FLOWCHART
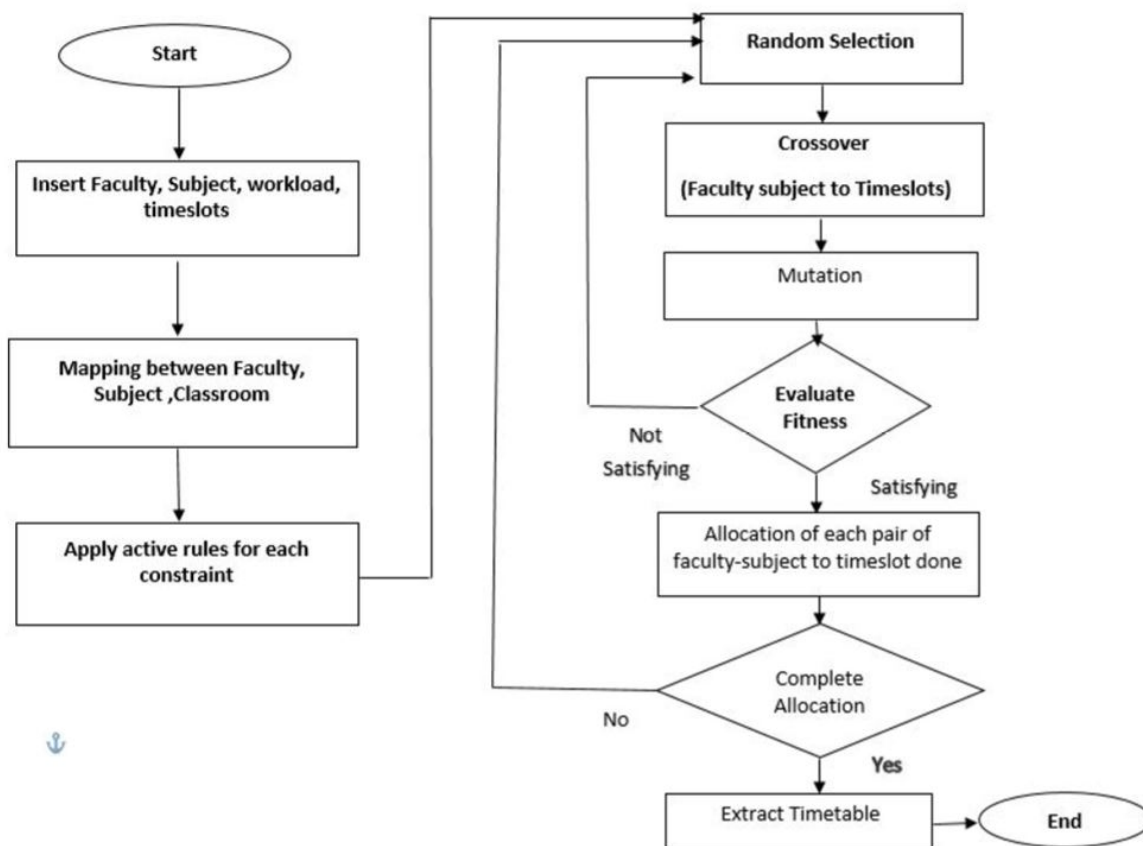
Figure 4.3: Use Case Diagram

Flowchart is a type of diagram that represents the workow. Flowchart is the sequence of actions involved in the system.Flowchart begins with the start symbol.

Admin inserts the faculty details, subject details, workload of the faculty and the lecture time slots. After successful insertion of all the details the admin maps subject to semester, faculty to subject and nally maps the faculty-subject data to classrooms. After mapping Admin applies constraints for the data that must be satisfied that is :

• A classroom must not be assigned to more than one faculty at a time.

• A faculty cannot teach more than one class at the same time.

• Every subject hours and practical sessions should be adjusted for a week.

• Faculties should get equal hours of lecture in a week

• Lunch break should be allocated properly

• Faculties should not be assigned for same time slots.

Then the genetic algorithm starts. It performs the following steps:

1)Random Selection Genetic algorithm

Randomly selects the mapped faculty-subject-classroom data and the time slots. Faculty-subject-classroom and time slots are like parents. So it does random selection of parents from large amount of data.

2)Crossover

In this step it does the crossover of the selected faculty-subject-classroom and time slot data.

3)Mutation

Mutation does random changes. This step is used only when the faculty is absent and needs to be replaced by the substitute faculty. So it does changes by replacing the absent faculty with the substitute faculty.

4)Evaluate Fitness

In this step the tness is evaluated, constraints are checked for the data which is assigned with the time slots. If the data which is assigned to the time slots does not satisfy the constraints then it is diverted to the random selection state, so that it can randomly selects new set of data then do the crossover and check for the tness. If the data assigned to the time slots satisfies all the constraints then it is moved to the next state. So now the allocation of faculty-subject-classroom data to time slots is done after satisfying all the constraint. Complete Allocation In this step it is checked if all the pair of faculty-subject-classroom is assigned to all specified time slots. If all the faculty-subject-classroom is not assigned to all the time slots then it move to random selection state and randomly selects new set of data. If all pair of faculty-subject-classroom data is assigned to all the timeslots then it moves to the next state. Extract Timetable In this step it generates the classwise, facultywise, master timetable. This is the last stage that is the end state of the owchart.

4.3   DETAILED DESIGN

4.3.1   Use case
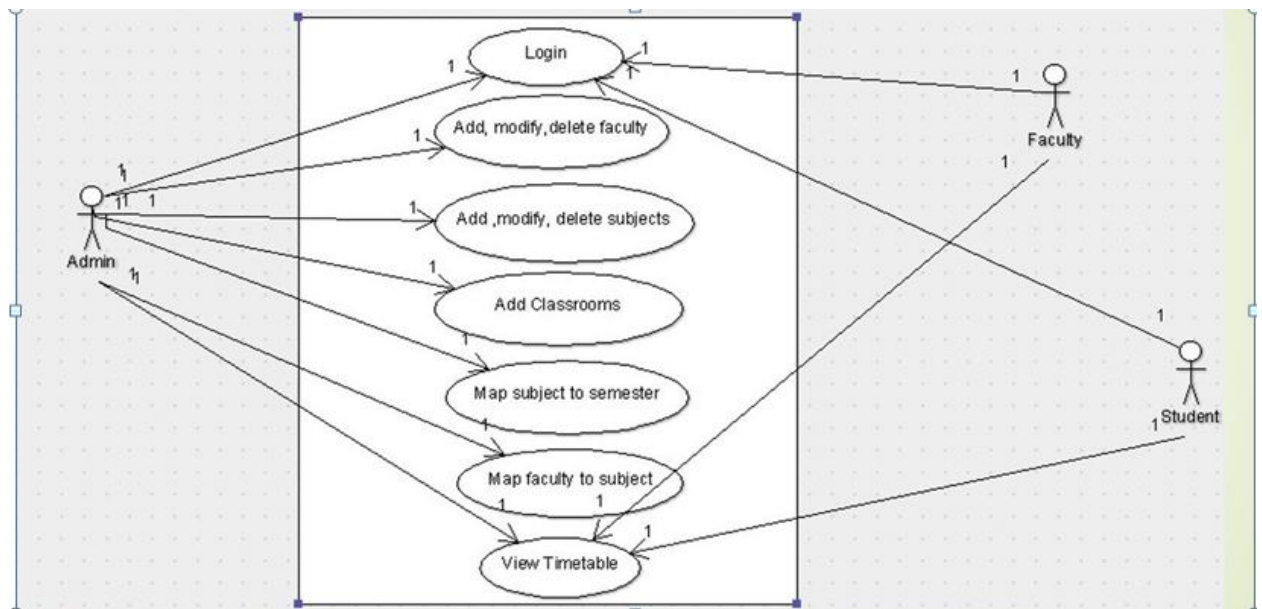
Figure 4.4: Use Case Diagram

A use case diagram in the Unified Modelling Language (UML) is a type of behaviour diagram defined by and created from a Use-case analysis. Its aim is to present a graphical overview of the functionality provided by a system in terms of actors, their goals, and any dependencies between those use cases. The main aim

of a use case diagram is to depict what system functions are performed for which actor. Role of the actors in the system can be depicted. Interaction amongst actions is not depicted on the use case diagram. If this interaction is essential to a coherent description of the desired behaviour, perhaps the system or use case boundaries should be re-examined. Alternatively, interaction among actions can be part of the assumption used in the use case.

Use case: A use case describes a sequence of action that provides something of measurable value to an actor is drawn as a horizontal ellipse.

Actors: An actor is a person, organization, or external system that plays a role in one or more interactions with system.

System boundary boxes (optional): A rectangle is drawn around the use cases, called the system boundary box, to indicate the scope of the system. Anything within the box represents functionality that is in scope and anything outside the box is not.

In the below use case diagram we describe the sequence of actions that the player does. Here the player initiates designing the system, then he/she selects a bunch of requirements and level. The player can view the settings menu where he can change different settings of the system. The player can view the incomplete system while designing. While designing the system, the player can pause working, resume the work after pausing or return to the main menu.

4.3.2 Activity Diagram
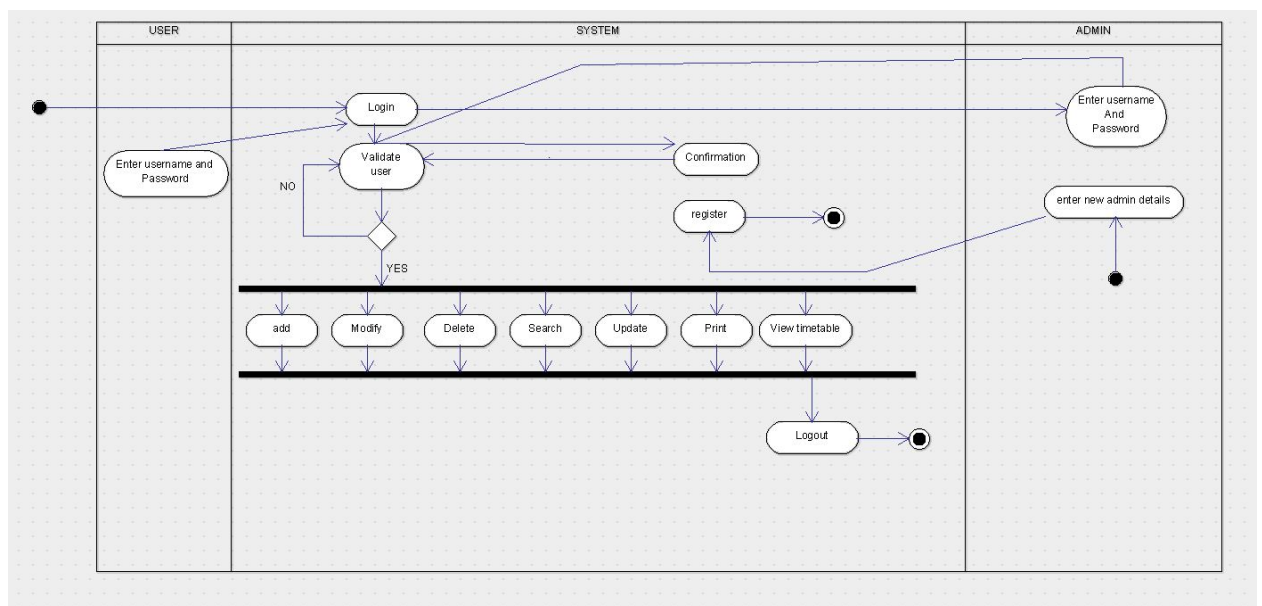
Figure 4.5: Use Case Diagram

Activity Diagram is defined as a Unified Modeling Language (UML) diagram that focuses on the execution and flow of the behavior of a system instead of implementation. It also called as object-oriented flowchart. Activity diagram includes activities that are built of actions which apply to behavioral modeling technology.
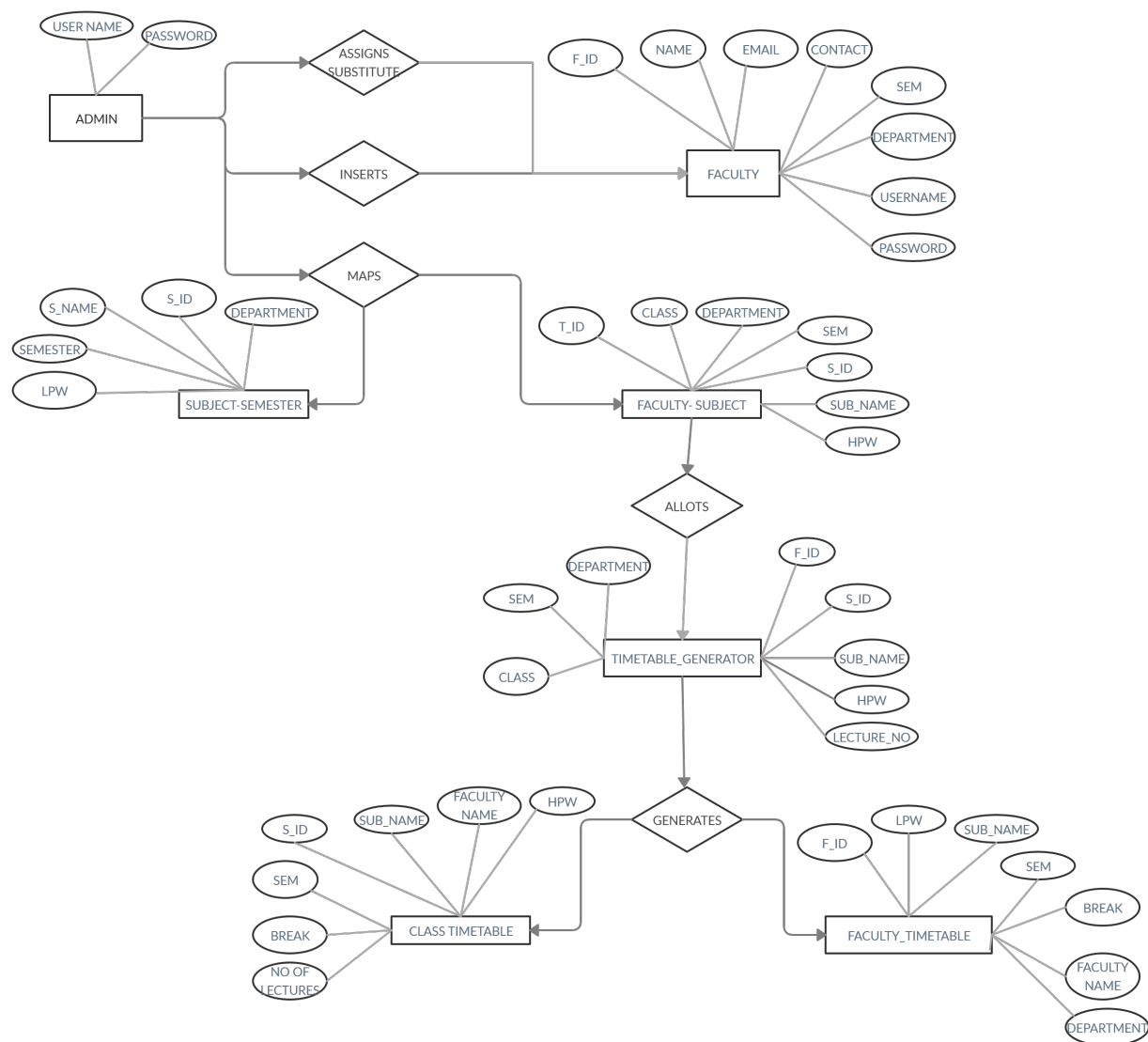
4.3.3   Entity Relationship Model

Figure 4.6: Entity Relationship Diagram

In software engineering, an Entity-Relationship Model (ERM) is an abstract and conceptual Representation of data, Entity-Relationship modeling method, used to produce a type of conceptual schema or schematic data model of a system, often a relational database. And its requirements in a top fashion. Diagram created by this process are called as Entity- Relationship diagrams, ER diagrams, or ERDS.

4.3.4 Data Flow Diagram
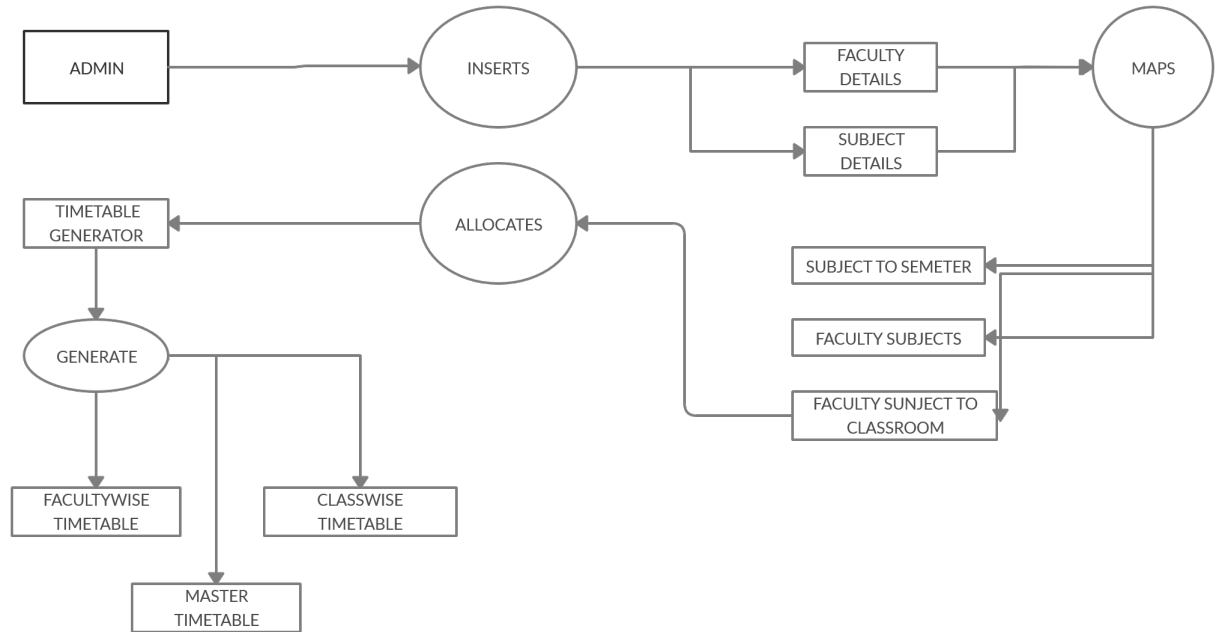
Figure 4.7: Data Flow Diagram

Data flow Diagram is used to graphically represent the flow of data in a business information system. DFD describes the process that are involved in a system, transfers data from the input to the file storage and report generation. Some of the basics that are used to represent a data flow diagram are:

- Process

- Notation

- Data Flow

In this diagram there are three entities i.e. admin, faculty and student. Admin inserts faculty details and maps subject to semester, faculty to subject and faculty-subject to classroom.The faculties will be able to view the timetable for the faculties as well as for students. They will be able to view the substitute also where as the students will only have access to the class timetable. For the allocation of the time slots Genetic Algorithm is used which generates faculty wise time table, class wise time table and a master time table.

4.3.5   Class Diagram
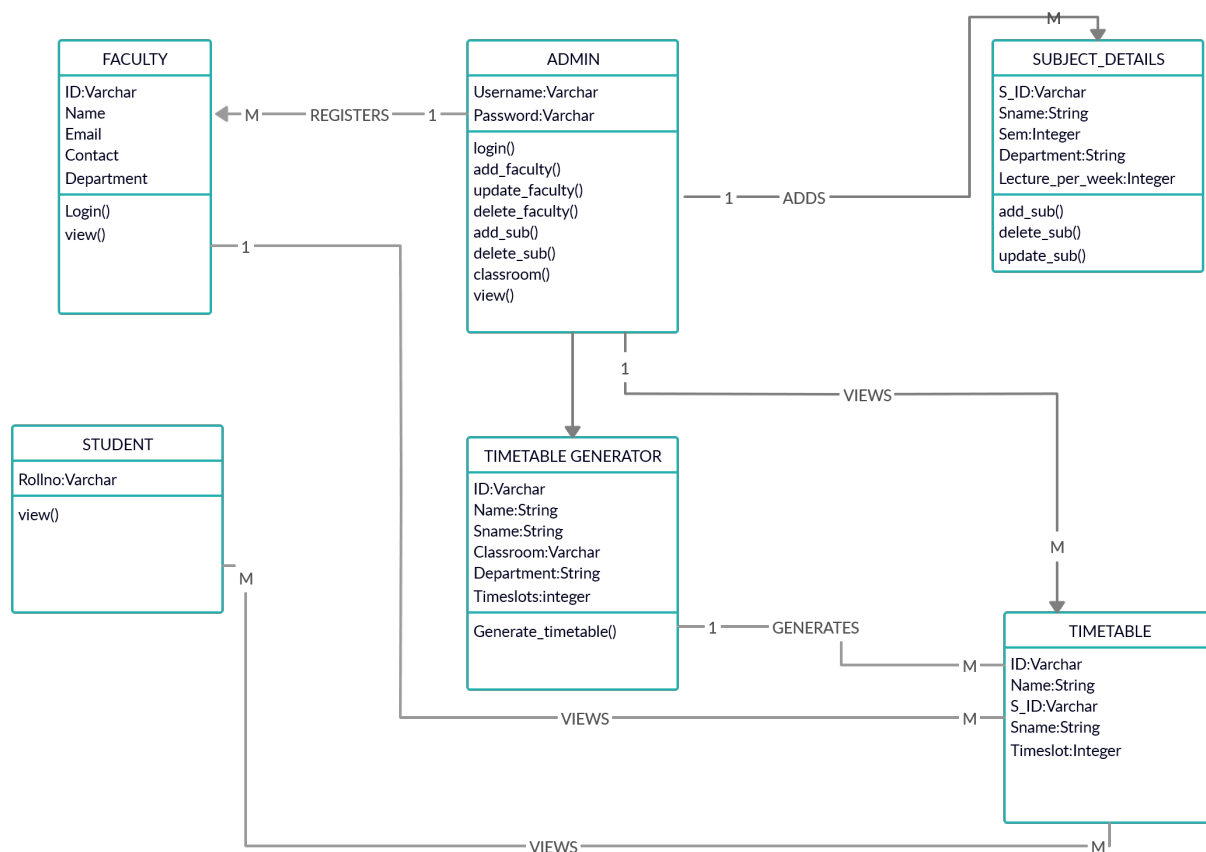
Figure 4.8: Class diagram

Class diagrams are the main building blocks of every object oriented methods where UML is standardized . The class diagram can be used to depict the classes, relationships, interface, association, and collaboration. Since classes are the building block of an application that is based on OOPs, so as the class diagram has appropriate structure to represent the classes, inheritance, relationships, and everything that OOPs have in its context. It describes various kinds of objects and the static relationship in between them.

Chapter 5

Implementation

HOME PAGE
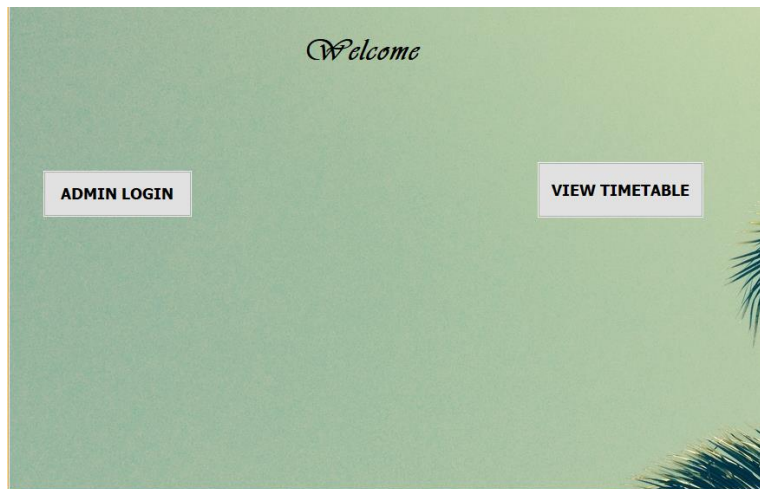
The first page of the software will consist of two options-

➢ It will allow the timetable to be viewed
➢ It will allow the admin to log into the software by directing it to the admin login page.

The username and the password will be provided by the super admin. The following image depicts the description of the login page-

ADMIN LOGIN

Admin logins through username and password which will be given by the Super Admin .On logging in the software, admin is able to perform the following basic tasks that are a must in any timetable generation process. This enables the smooth functioning of the classes. We must note that the admin in this case is the Principal of the college.

MENU PAGE AFTER ADMIN LOG IN

• **Add/Update faculty**

In this function the admin will be able to add a new faculty or update the existing one depending upon the needs and the curriculum demands.

• **Add/update**

subject details The syllabus and the subjects change as the university varies. This system allows the admin to add new subjects or to update the existing ones if there are any changes in the syllabus.

• **Map faculties to subject**

On a click the faculties will automatically get mapped to the subject. This will be done using Genetic Algorithm. The Genetic Algorithm, satisfying all the constraints will provide with the best possible output. • Substitute faculty If any faculty is absent a substitute must be assigned in order to continue the smooth functioning of classes.

ADDING FACULTY DETAILS

Admin inserts the faculty details such as faulty Id, faculty name, email, contact, qualification, specialization, department of the faculty. Admin also assigns password and workload for the faculty. Faculty Id is taken as primary key. Admin can add, update, delete the faculty.

SUBJECT DETAILS

Admin inserts the subject details like subject ID, subject name, department, year and semester. Subject Id is taken as primary key. Admin can add, update, and delete the subject.

MAPPING

Admin does the maps the facuty and the subject. This includes semester, subject Id, subject name, faculty Id, department, classroom. Faculty Id is taken as primary key in faculty table and subject Id is taken as primary key in subject table. In mapping table faculty Id and subject Id is taken as foreign key to map the faculty and subject details.

Chapter 6

CONCLUSION AND FURTHER SCOPE

6.1 Conclusion

The project titled "Automated Timetable Generation" has been developed using the genetic algorithm and was implemented using Java programming language. The automated timetable generation is an automated system that generates automatic timetable when inputs are fed into the system .The system takes care of all the constraints and requirements that are required to draw a successful output. Incremental model is used in the system which designs and develops at each stage followed by testing and eventually generating an output. The system evaluates and draws output until a healthy and the potential output is obtained . It results in reduction of time consumed in manual preparation of timetable thus saving time as well as efforts.

6.2 FURTHER SCOPE

The software will be used by many educational institute to automatically generate the timetable. It will generate master timetable, faculty wise and class wise timetable

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ACRONYMS

- GA-Genetic algorithm

- HOD-Head of the department

- F(x)-Fitness function

- UML -Unified Modeling Language

- OOPs - Object Oriented Programming System