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Design and Implementation of Web-based Smart Class Routine Management System for Educational Institutes

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Abstract: Smart Class Routine Management System (SCRMS) is a web application that able to generate an error-free and effective class schedule automatically. At present, most of the academic institutes like schools, colleges, and universities follow the traditional manual process to create class routines. Thus, there is a high probability of making errors in overlapping timetable period or slot and definitely a valuable amount of time is wasted as there are many things to be considered. SCRMS comes with the intension to provide better and dynamic timetable management service and to reduce the workload of the routine management team. It will assist in the automatic management of all periods. The user or the routine management team simply needs to create a schedule for a batch, and the system will automatically configure all connected timetables (Teachers, Class Rooms, and Labs). SCRMS also contains an embedded database which stores the records of every batch, classroom, lab and teacher with their respective tables. In this system, class distribution will be more reliable and accurate. This web application is secured and really easy to use. In this application, the teacher's routine will be generated automatically and the student's class routine will be provided by an admin. In this paper, the SCRMS is designed and developed as a web application by PHP language with MySQL database. The programming languages and tools used to develop this system are PHP, Laravel, Bootstrap, MySQL, JavaScript, HTML, CSS, Ajax, and JQuery which are very efficient in making such dynamic web-based system. Since, the developed system is flexible, scalable, and modular, does not just meet the needs of a specific department/ institute but can be adapted and used by any other departments/ organizations.

Index Terms: Class Schedule Management, Web Application, Web Server, MySQL Database, ER-Model, PHP.

1. Introduction

Scheduling and managing a routine is a difficult task, however it is an essential part of human life. Routines help human beings to develop self-discipline, make their lives more productive, and relieve stress. Therefore efficient management of routine is necessary. The investment of time spent in the creation of routines is worthless and time-consuming. Starting from personal life to corporate life, in educational institutions or in offices, scheduling and managing time schedule is needed in different ways. For example, making the routine of any department of a university takes a lot of time, and doing it manually is really hard as that individual creating it should ensure that the arrangement of the routine should conform to everyone preference related to it [1, 2]. In our research, we have built an intelligent routine management system using the genetic algorithm by which a routine will be automatically generated using required data. It is commonly seen that most of the academic institute like school, college and the each department of the university have prepared their class timetable for every semester/ year manually which very laborious, difficult and

time consuming. There are several important issues we have to take into account to create a good class routine like allocation of teachers, staffs, courses, class rooms, consideration of the theory and lab timing of each course in a way so that they do not clash with each other at the same time etc. Therefore, making a schedule manually for is a very tough and challenging task. By conducting some research and studies, we found that it is possible to build a dynamic routine management system by which the schedule will be prepared automatically using given data. To the best of our knowledge, there is no works reported in the literature about the implementation of a complete dynamic class routine management system. In [3], Kabir MH et al. developed a smart attendance management system for academic institutes and integrated a class routine management module. But authors mainly focused on the attendance and leave management system in this paper, they implemented routine management system partially. In this research work, we have developed an automated system to build class routines of any academic organization in an easy and efficient way to decrease the manual tasks. This system is able to take the academic institutes one step forward of using the modern technologies, to save time and to present an optimized class schedule without any type of clashes. The main objective of this work make an user friendly, error free, and fully dynamic web-based class routine management system called SCRMS which is faster than manual routine management system and very helpful to teachers, students and concerned managerial body of the educational institutes. The technologies used in this web application are PHP, MYSQL, HTML, and CSS. The overall business logic is implemented using PHP. MYSQL is used to provide the database functionality in the system to store users' data. HTML and CSS are used to design the front-end of the web application which are very reliable and mostly used all over the world. By using the cascading style sheets (CSS), all the front end design settings are stored in a single CSS file and whenever there is a need to make any change, we don't need to change it on every page, we change only one value in the CSS file and this change is made to the whole website [4]-[10]. In [17], M. Amjad et al. to investigate and find out the parameters that affects the web performance and it has been tested on ecommerce applications of Bangladesh, where eleven parameters are considered and these are fully loaded (requests), first CPU idle, speed index, start render, load time, fully loaded (time), document complete (time), last painted hero, first contentful paint, and first byte. In [18], M. N. Khalid et al. developed Web Vulnerability Finder (WVF): Automated Black Box Web Vulnerability Scanner, in this paper can automatically analyze websites with the aim of finding web vulnerabilities. By applying the tool to some websites, we have found 45 exploitable XSS, SQL Injection 45, Directory Discloser 38 and Local/remote file inclusion 40 vulnerabilities. In [19] the author point out the difficulties of security implementation of web applications and presents a framework for developing secure web applications. Also the priority and importance of use case in UML are pointed out. In this paper, we show a way to configure the routing of a dynamic web application in JSON (JavaScript Object Notation [21]) format to generate code for a dynamic web application.

2. System Requirement Analysis

To be used efficiently, all computer software needs certain hardware components and necessary software resources to be present on a computer. These prerequisites are known as system requirements and are often used as a guideline as opposed to an absolute rule.

User Requirements

The user requirement for this system is to make the system fast, flexible, less prone to error, reduce expenses and save time. Time can be saved by scheduling the routine in an automatic manner. The system helps the department of a university or any type of educational institutions to make an automated dynamic class schedule which can save time for the department or routine management team.

Functional Requirements

This section gives the functional requirement that applies to the routine management system. There are three sub-modules in our developed system: Teacher Module, Student Module, and Administrator Module for three types of users: teachers, students, and administrator respectively. In the Teacher Module and Student module, all the teachers and students can view their own class schedule and download PDF of the routine respectively. Teachers can also modify and suggest any change of his/ her own schedule will be allowed by the system administrator (admin). The admin can create, update, edit, delete, verify, and view the class routines and teachers/ students' profiles, can add courses, and can assign courses to the teacher in the administrator module. The registration of the students and teachers in the system will be verified by the admin. To maintain all the administrative function, the admin has the full authority and access over the system. Admin have to login the system by using username and password. The vital role played by the admin in the system is to assign role to each user of system and provide username as well as password thus registration of all users will be completed through the administrator. Every teacher and student can login into the website after providing the username as well as passwords. Teachers will get a profile after registration. This profile shows all the basic information about the teacher. Admin assign different courses to different teacher. When a course is assigned to a teacher then it appears in his/ her profile. Then the teacher can check his/ her own class timetable.

Non-Functional Requirements

Non-functional requirements specify the criteria that can be used to judge the operation of a system rather than specific behaviors. They are contrasted with functional requirements that define specific behavior or functions. Non-functional requirements of the developed SCRMS are identified as below:

- Time slots are fixed but we will able to edit, add, and delete different time slots as needed.
- Every semester and session are changeable.
- All information is editable/ addable/ delete able/ updateable.
- Teachers, students, and admin can easily print their routine.
- Teachers and admin can easily update their profile and other information.
- Teachers can log in their profile check their own routine so that the system must be secured.
- No user would be able to access the registered part of the application without logging on to the system.
- If there is any additional data or information that will need in the routine, users can add this.
- The web application must be device independent.
- The application would be fully compatible with any type of browser.
- The application must support multiple users at a time.
- The system would be available anytime from anywhere.

Hardware and Software Requirements

The necessary requirements for both Software & Hardware parts to run SCRMS on the computer without any obstacles:

Hardware Requirements

Hardware interfaces can be divided into two sides one is server-side and another is client-side. Server-side includes the following hardware:

Operating System: Windows 7 or higher
Processor: Pentium 3.0 GHz or higher
RAM: 512 MB or more and
Hard Drive: 10 GB or more.
Client-side includes the following hardware:
Operating System: Windows 7 or above/ MAC/ UNIX/ Android
Processor: Pentium III 2.0 GHz or higher
RAM: 512 MB or more.
Hard Drive: Any.

Software Requirements

Tool: Notepad++, Web Browser
Coding Languages: HTML, CSS, PHP, JSP, HTML, JavaScript
Server: XAMPP Server

3. System Design Methodology

The proposed smart routine management system offers a different segment that helps to manage class schedules in an interactive and efficient way. In this section, a proper description of design methodologies and approaches used for SCRMS is given.

Database Management System Design

A DBMS is a system in which related data is stored in an efficient or compact mode. "Efficient" means that the data which is stored in the DBMS can be accessed quickly and "compact" means that the data takes up very little space in the computer's memory. The phrase "related data" means that the data stored pertains to a particular topic. Four components of a database system are data, hardware, software, and users [11]-[14]. DBMS design is the process of producing a detailed data model of the database. This data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a data definition language, which can then be used to create a database [15]-[16].

Data Flow Diagram (DFD)

In this section, we have presented the architectural data flow diagram of every sectional part of the admin, teacher, and student panel. The working process shown in the data flow diagram for admin panel, teacher panel, and student

panel will be processed step by step.

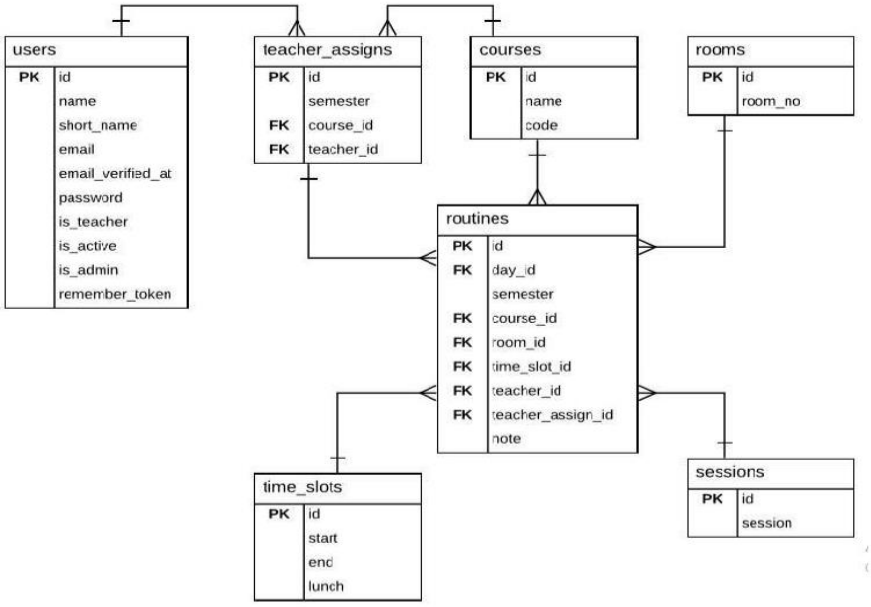

Fig.1. E-R Diagram for Database Design.

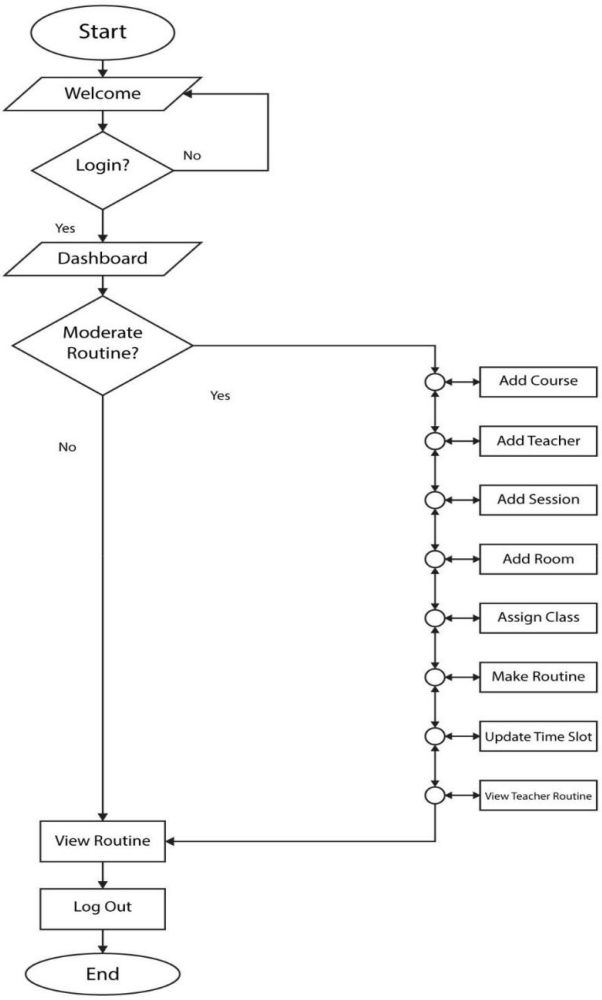

Fig.2. Admin Panel Data Flow Diagram.

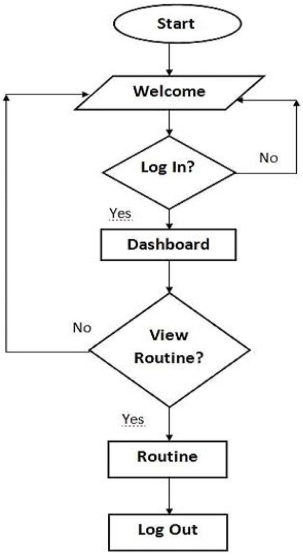

Fig.3. Teacher Panel Data Flow Diagram.

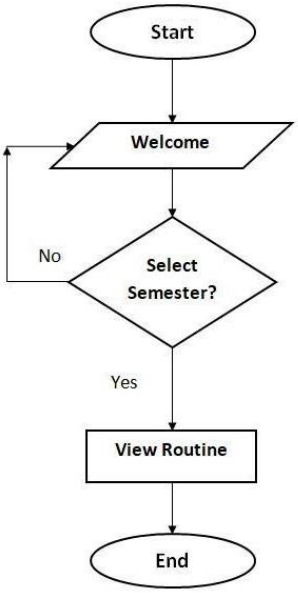

Fig.4. Student Panel Data Flow Diagram.

Use Case Diagram

A use case diagram is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. Basic function of each user is depicted in the figure 5.

Algorithm Design

Here, we have presented the algorithms used in the SCRMS described briefly in very simple words.

Algorithm for Admin Panel

An admin firstly login into the SCRMS. Then, he/ she can edit, moderate, and update the routine as required.
Step 1: Start
Step 2: At first logs into the system
Step 3: Entry info to prepare the routine as per the requirement
Step 4: Update the routine as per the requirement
Step 5: View teacher's individual routine if needed
Step 6: Finally logout the system
Step 7: End

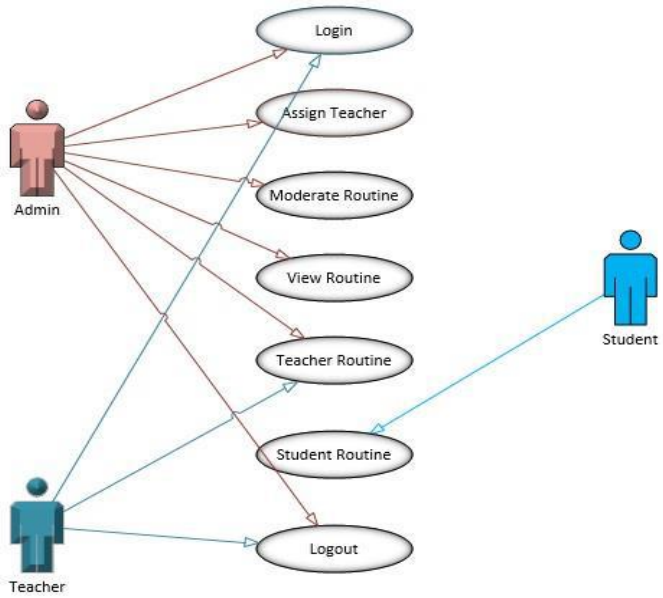

Fig.5. Use Case Diagram of the Proposed System.

Algorithm for Teacher Panel

A teacher firstly login into routine. Then, he/ she only can view his weekly routine as required.
Step 1: Start
Step 2: At first logs into the system
Step 3: View teacher's own routine
Step 4: finally logout the system
Step 5: End

Algorithm for Student Panel

Students can view their routines by selecting their semester from the search bar at the homepage.
Step 1: Start
Step 2: At first select semester
Step 3: Finally view semester wise routine and show time slots
Step 4: End

4. Implementation and Result Analysis

We have used a number of programming languages and software development tools for developing our smart class routine management system. HTML (Hypertext Markup Language), version: HTML5, CSS (Cascading Style Sheets), version: CSS3, PHP (Hypertext Preprocessor), version: PHP 7.1.18, Laravel Framework, version: 5.4, JS (JavaScript), version: JavaScript 1.8.5, MySQL (Structured Query Language), version: 8.0.1, Bootstrap Framework, version 4.1, Ajax (JS Library) and jQuery (JS Library) etc. are successfully to implement the proposed dynamic class routine management system.

Home Page

This is the home page or start page of our developed system shown in figure 6. When admin or any user wants to go through the application, he/ she can see this page first.

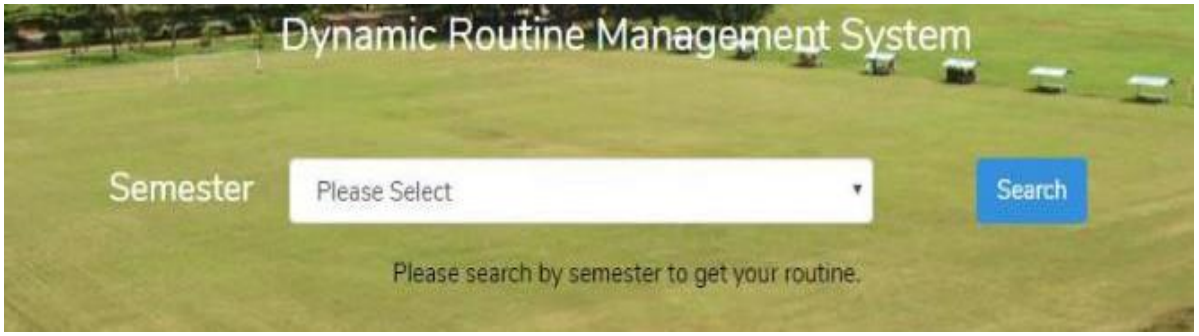

Fig.6. Home page of dynamic routine management system.

Login Page

For security purpose each type of users have to login by inputting username and password to access the system. Only registered and authorized users (admin, teachers, and students) can enter into the web application. Figure 7 shows the login page. If admin or any user clicks the login button he/she can see the page.

Fig.7. Login page of dynamic routine management system.

Dashboard

Once admin log into the routine, at first he/ she can see the dashboard page. In this page, we simply show the total number of teachers, courses and rooms included in the system. The dashboard shown in figure 8 represents the testing data and information.

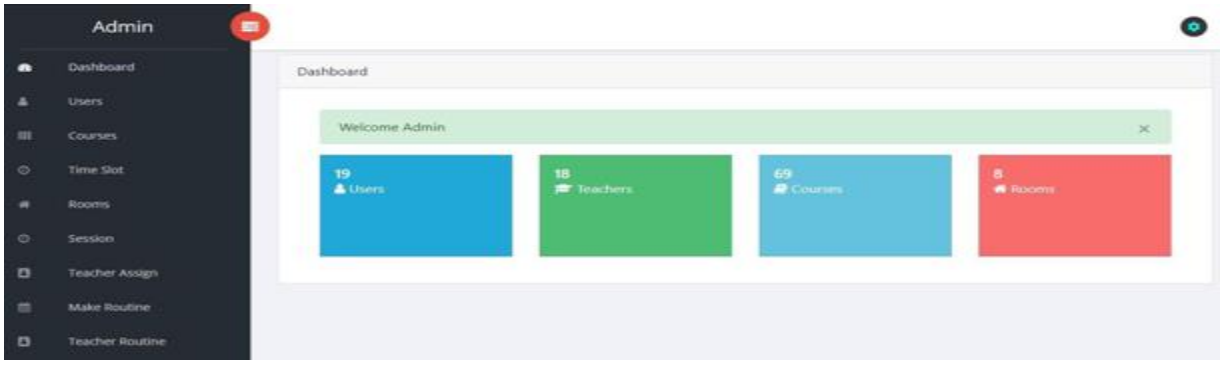

Fig.8. Dashboard of the routine management system.

Create User

Admin can create/ add user. This is the user registration form. Admin can create user by providing the necessary information shown in the figure 9.

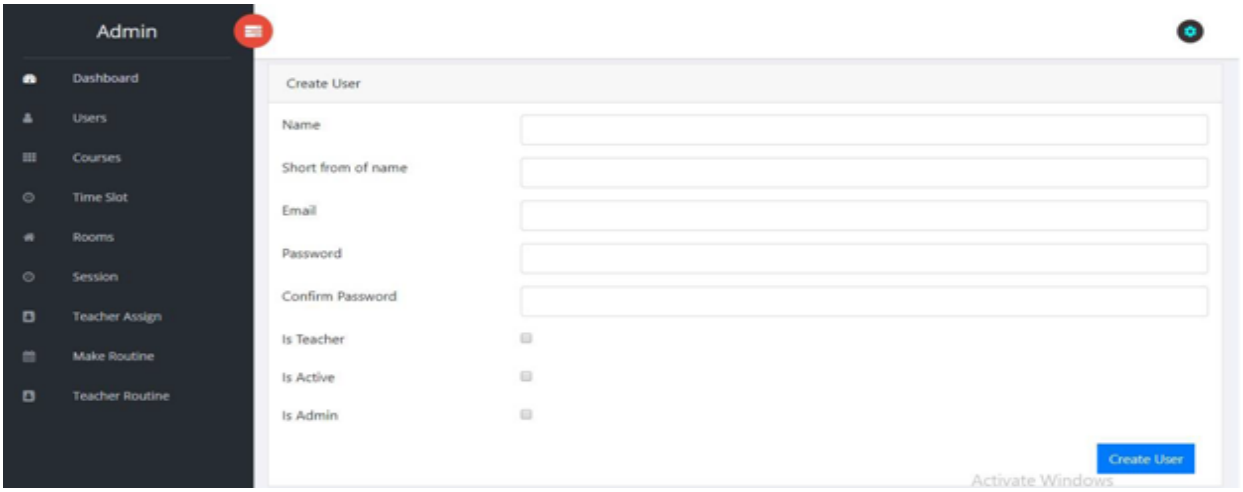

Fig.9. Create User Panel.

Create Course

If admin want to add course, he/ she have to click the 'Add Course' button, then he can see the create course page presented in the figure 10. To add a course in the system, we have to provide course credit and course title.

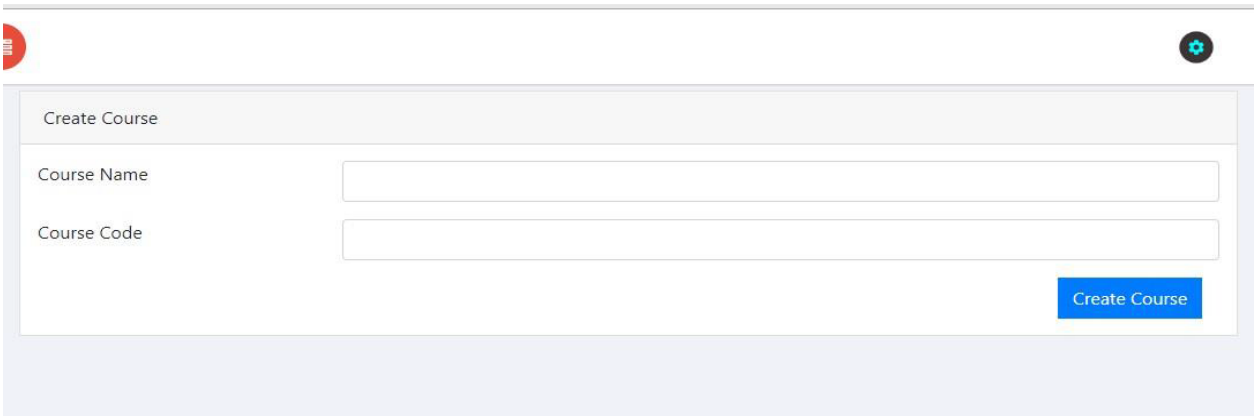

Fig.10. Course registration form.

Time Slots

This is the time slot management page depicted in figure 11. Here, we can add the number of time slots, start time and ending time of the class periods. We can see here 'Status' and 'Action' functionality. Status option of a period is used to identify whether the period is lunch time /class time/ prayer time/ break time. At the top right corner you can see the '+Add Time Slot' button which is used to add new time slot. Admin can easily edit and delete time slot using action function.

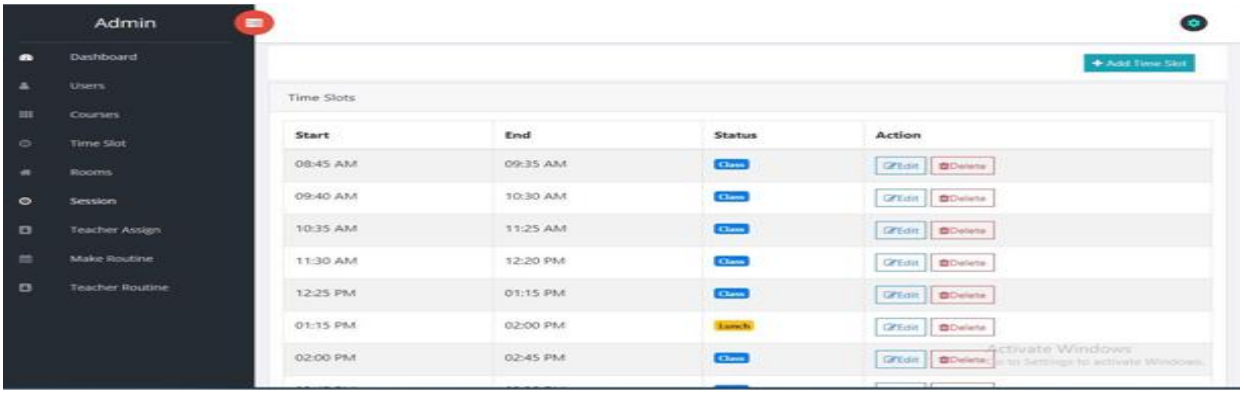

Fig.11. Time slot management page.

Class Rooms

In this panel, we can see all the room number as a list and detail information of each room. We can edit or delete the room number in this page which presented in figure 12. At the top right corner, we can see the '+Add Room' button, which is used to add new room no.

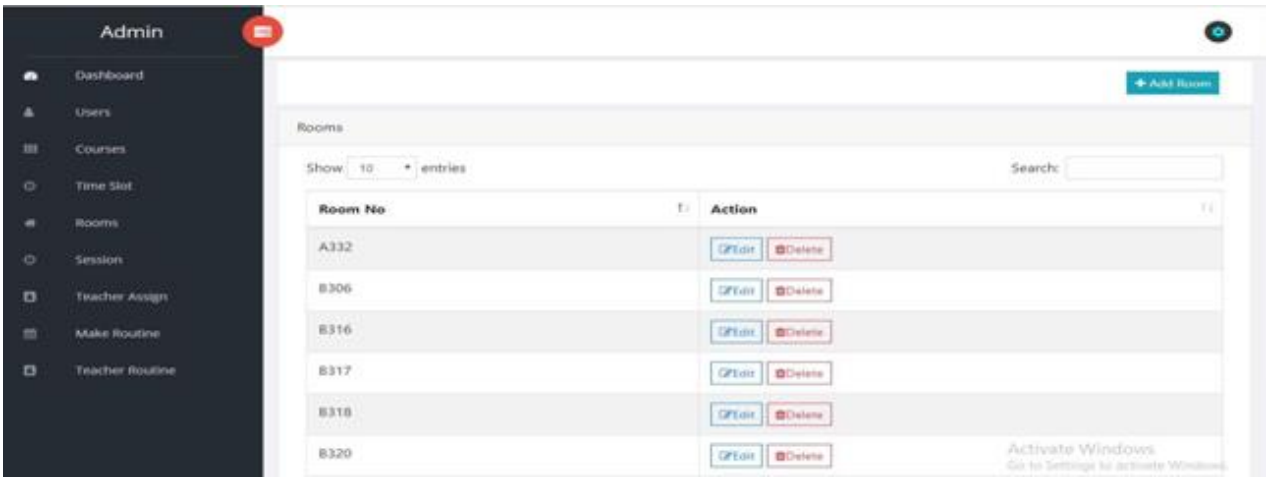

Fig.12. Class Room and Lab Room information page.

Add Teacher and Assign Courses

From figure 12, it is seen that admin can add relevant teachers' information and also can assign corresponding to a teacher. Selected course(s) will be assigned to a teacher for selected semester. Admin/ teacher can edit or delete this section.

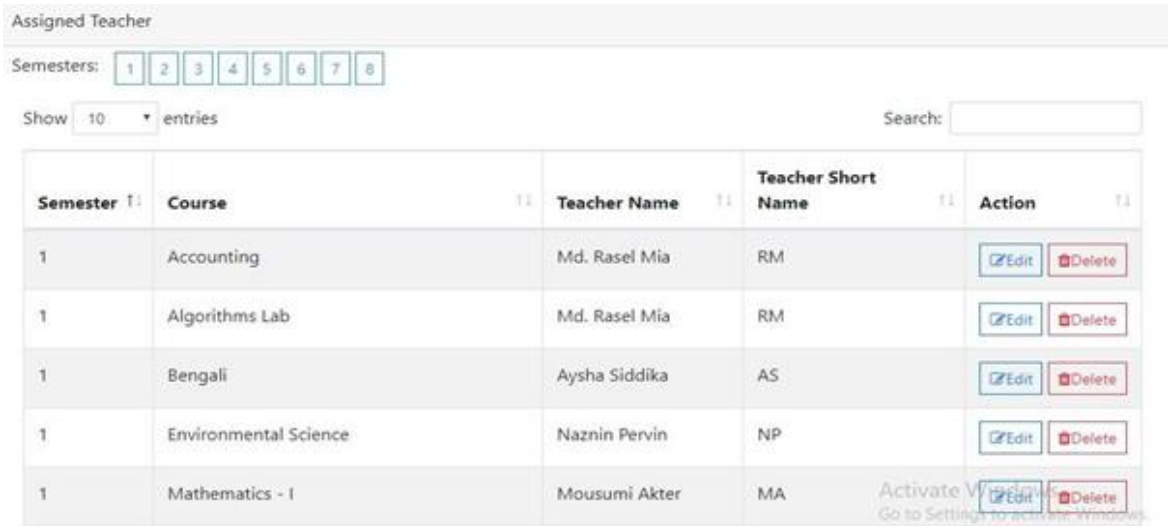

Fig.13. Add teacher and Assign Course to the teacher.

Create Final Routine

Admin can create the class routine using this page shown in figure 13. Here, admin can add/ delete/ edit related data information. Only admin can moderate this section. Figure 13 shows how to prepare class routine. Multiple class routine can be managed for each academic batch of a specific department. After providing class routine related data, we can view the class routine.

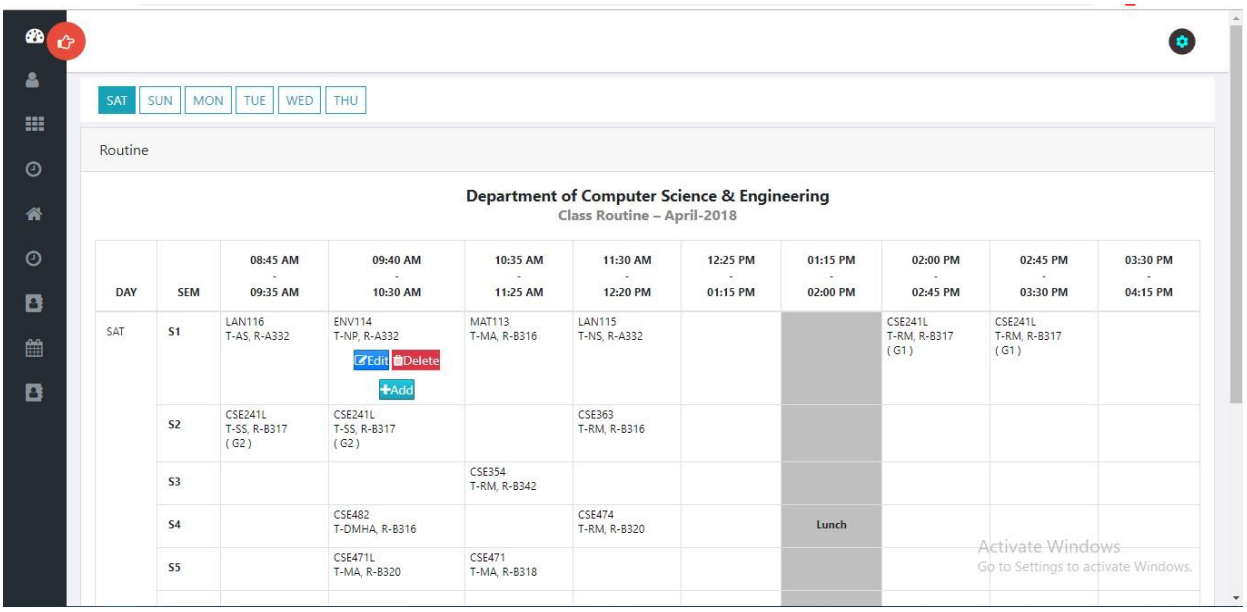

Fig.14. Create Class Routine.

5. Conclusions

In this paper, we have presented an efficient and automated smart class routine management system which can be very helpful for academic personnel's. The system demonstrated here provides a completely automated solution to the class schedule management related problems that is very essential for any kind of academic institute like school, college and university. This is a significant improvement over of manual works for routine management. Our developed system is able to create class routine without any time loss and problem of overlapping time or room also reduce huge hassle of the routine management team. This application can also provide students, teachers, class rooms, and lab rooms' related importation information which can be searched, referenced, compared, changed and controlled from the database easily with a minimum time and cost. Users can access to the developed web application anytime and in anywhere with computer/ smart phone. The most effective point of this system that has flexibility and scalability which is very important for the future, anyone can do more development on it.

References

[1] M. K. Kakkar, J. Singla, N. Garg, G. Gupta, P. Srivastava, and A. Kumar, "Class Schedule Generation using Evolutionary Algorithms," J. Phys. Conf. Ser., vol. 1950, no. 1, p. 012067, 2021.
[2] "Creating classroom procedures and routines," in Teaching Discipline & Self-Respect: Effective Strategies, Anecdotes, and Lessons for Successful Classroom Management, Corwin Press, 2014, pp. 29–50.
[3] M. H. Kabir, S. Roy, M. T. Ahmed, and M. Alam, "Smart Attendance and Leave Management System Using Fingerprint Recognition for Students and Employees in Academic Institute," International Journal of Scientific & Technology Research, vol. 10, no. 6, pp. 268-276, June 2021
[4] R. Connolly and R. Hoar, Fundamentals of web development, 2nd ed. Upper Saddle River, NJ: Pearson, 2017.
[5] M. Oppitz and P. Tomsu, "World Wide Web," in Inventing the Cloud Century, Cham: Springer International Publishing, 2018, pp. 229–266.
[6] L. M. Surhone, M. T. Timpledon, and S. F. Marseken, Xampp. Betascript Publishing, 2010
[7] L. Beighley, Head First PHP & MySQL, 2nd Edition. O'Reilly Media, 2013.
[8] Robin, N., Learning PHP, MYSQL, JavaScript, CSS and HTML5. 3rd Edition. O'Reilly Media, 2014.
[9] Mattew MacDonald, HTML5: The Missing Manual. 2nd Edition. O'Reilly Media, 2014.
[10] L. Shklar and R. Rosen, Web application architecture: Principles, protocols and practices, 2nd Edition. Chichester, England: John Wiley & Sons, 2011.
[11] Nicholas C. Zakas. Professional JavaScript for Web Developers. 3rd Edition, Jhon Wiley and Sons, 2013, pp. 431-451.
[12] A. Kosmaczewski, Mobile JavaScript Application Development: Bringing web programming to mobile devices. Sebastopol, CA: O'Reilly Media, 2012.
[13] L. Liu and M. T. Ozsu, Eds., Encyclopedia of database systems. New York, NY: Springer, 2018.
[14] Database Design & Develpmt & sql Server, Singapore: Addison Wesley Longman, 2006.
[15] C. Russell and J. Stephens, Beginning MySQL database design and optimization: From novice to professional, 1st ed. Berlin, Germany: APress, 2004.
[16] R. D. Schneider, MySQL Database Design and Tuning. Upper Saddle River, NJ: MySQL Press, 2005.

[17] M. Amjad, M. T. Hossain, R. Hassan, and M. A. Rahman, “Web Application Performance Analysis of E-Commerce Sites in Bangladesh: An Empirical Study,” I.J. Information Engineering and Electronic Business, 2021, 2, 47-54.
[18] M. N. Khalid, M. iqbal, K. Rasheed, and M. M. Abid ,“Web Vulnerability Finder (WVF): Automated Black- Box Web Vulnerability Scanner,” I.J. Information Technology and Computer Science, 2020, 4, 38-46.
[19] Nitish Pathak, Girish Sharma, B.M.Singh, Experimental Analysis of SPF Based Secure Web Application, International Journal of Modern Education and Computer Science (IJMECS), Vol.7, No.2, 48-55 (2015).
[20] N. Kaur, H. Aggarwal,"Evaluation of Information Retrieval Based Ontology Development Editors for Semantic Web", International Journal of Modern Education and Computer Science (IJMECS), Vol.9, No.7, pp.63-73, 2017.
[21] JSON, http://www.json.org.
[22] Amira Abdelatey, Mohamed Elkawkagy, Ashraf Elsisi, Arabi Keshk, "Improving Matching Web Service Security Policy Based on Semantics ", International Journal of Information Technology and Computer Science (IJITCS),Vol.8, No.12, pp.67-74, 2016.

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