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WEB BASED TIMETABLE SCHEDULING SYSTEM FOR APPLIED SCIENCES AT COLLEGE OF ARTS & SCIENCES (CAS)

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ABSTRACT

Timetabling is a problem that concerns every teaching institution. Every year a new timetable must be produced to take account of staff, student and course changes causing a necessarily large amount of work. CAS faces a considerable amount of difficulties especially before the start of academic semesters due to the increased number of students and courses. The main objective of this study is to develop a web-based application for timetable scheduling for the CAS. Implementing this prototype in CAS will return in many benefits for both the CAS staff and the students. However some work and studies still need to be done to this system as described in the recommendations section.

Keywods:- *Web Based, System, Timetable, Management.*

I. INTRODUCTION

As demand for education increases and diversifies, so does the difficulty of designing workable timetables for schools and academic institutions. Besides the intractability of the basic problem, there is an increasing variety of constraints that come into play (Rahoual, 2003).

Timetabling is a problem that concerns every teaching institution. Every year a new timetable must be produced to take account of staff, student and course changes causing a necessarily large amount of work. Computer timetabling and administration systems do exist to ease this burden but each timetabling problem is as individual as the institution from which it originates (Burke, 2000).

Traditionally, timetabling at University Utara Malaysia for postgraduate programmes has been departmentally led. Departments have had a great deal of autonomy in creating their own timetables, and either a member of academic staff or a departmental administrator is allocated to deal with the timetable. Timetabling has therefore become something of a "black art", with individuals developing different methods of timetabling depending on their professional backgrounds, and concerns have arisen about the lack of a pooled knowledge base for timetabling.

Although new space cannot be created by an automated timetabling system, it can help to avoid such problems through more efficient use of existing resources and by enabling an overview of timetabling so that under-used resources can be identified (Geller, 2006).

II. PROBLEM STATEMENT

Scheduling can be a time-consuming process, whether it is for a regular class or a special event, factors such as capacity requirements, instructor preferences and audiovisual needs can make the task more difficult. The need to deal with conflicting course requirements has become increasingly important over the past several years. Often, these requirements are elastic and imprecise in nature.

The College of Arts and Sciences – Applied Sciences Post Graduate Programmes faces a considerable amount of difficulties and problems especially before the start of academic semesters due to the increased number of students and courses.

There are four post graduate coursework programmes, MSc IS, MSc ICT, MSc IT and MSc technopreneurship. There are limited number of rooms available for the Post Graduate classes and there are about 30 – 40 courses per semester. Thus this study propose a web-based timetable scheduling system for applied sciences at CAS

III. RESEARCH OBJECTIVE

The main objective of this study is to develop a web-based application for timetable scheduling for the College of Arts and Sciences – UUM.

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The sub objectives of the study are:

(i) To identify the requirements of the system

(ii) To design the system.

(iii) To develop a prototype of the system.

IV. RESEARCH QUESTION

What is the best way to enable CAS management to produce a workable timetable?

V. SCOPE AND LIMITATIONS

The system is designed for applied sciences at the college of arts and sciences and will meet the timetabling requirements for the Post Graduate coursework programmes.

VI. RESEARCH SIGNIFICANCE

The significance of this study is it provide many benefits to many parties involved in the educational process and the management of educational institutions which include the following

a) Reduced management overhead.

b) Better utilization of campus resources.

c) Better distribution of rooms between courses

d) Increased profits from leasing conference room.

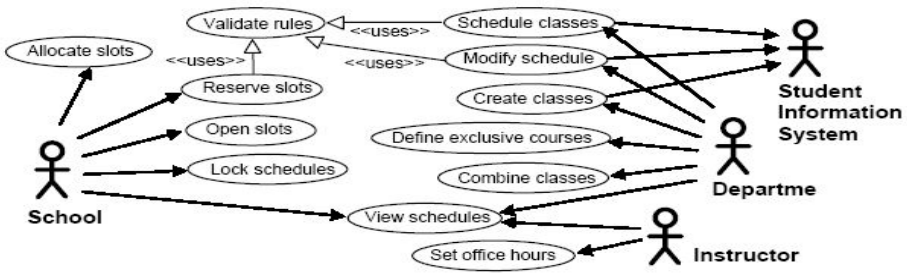
e) The web-based system will be available any where and any time.

VII. LITERATURE REVIEW

Resource Management and Timetable Problems

In its most general context, scheduling involves the arrangement, coordination, and planning of the utilization of resources to achieve an objective (Fang, 2005). Course timetabling problems particularly address the optimal utilization of classrooms and timeslots in sequencing lectures between instructors and students. During the construction of a timetable, one of the challenges is to ensure no constraints of faculty, courses, classrooms, timeslots, or students are violated. These types of resource-constrained schedule optimization problems have been long term studied with a huge volume of work in both operational research and artificial intelligence field (Colorni et al, 1998; Chahal et al, 1989).

One major reason for this is because it is not easy to express and formulate precisely the requirements and constraints for real-life timetabling tasks (Burke et al., 1997). As a consequence, researchers have generally worked in the past few decades on approximation solutions for this type of problems (Ojha et al., 2000; Tam et al., 2003



Yoshikawa et al., 1996).

Figure 1: The Use Case Model of the University Course Scheduling System (Fang, 2005)

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VIII. UNIVERSITY COURSE SCHEDULING

In academic institutions, nested groups of students (comprising streams, sections) are concerned by a set of subjects. A subject may be a lecture of some specific course or a tutoring or a lab, or any other meeting involving the group on a regular basis. For example, the lecture of the course entitled MATH3802A is a subject. Tutoring associated with the same course is another subject. Each subject takes a certain length of time whose unit is referred to as a 'period'. Each subject may be broken down into a number of meetings to be scheduled (Yellen, 2003; Burke, 2004).

IX. APPROACHES TO TIMETABLING

To solve the timetabling problem (TTP) is to assign a qualified teacher to each subject and a time-slot together with a classroom of a suitable capacity and characteristics to each meeting. The assignment of times-slots, classrooms and teachers is subject to constraint that depend on the nature of the institution and its priorities (Filho, 2001). These constraints fall into three categories: physical constraints, which provide among others that no student can attend two different meetings at the same time; preference constraints and specification constraints bearing on some particular meetings, which, for example, must be held in some specified time window (Petrovic, 2004).

X. RESEARCH METHODOLOGY

According to Vaishnavi and Kuechler (2004), the design research methodology or sometimes called "Improvement Research" contained the major steps: Awareness of the Problem, Suggestion, Development, Evaluation and conclusion as shown in the figure.

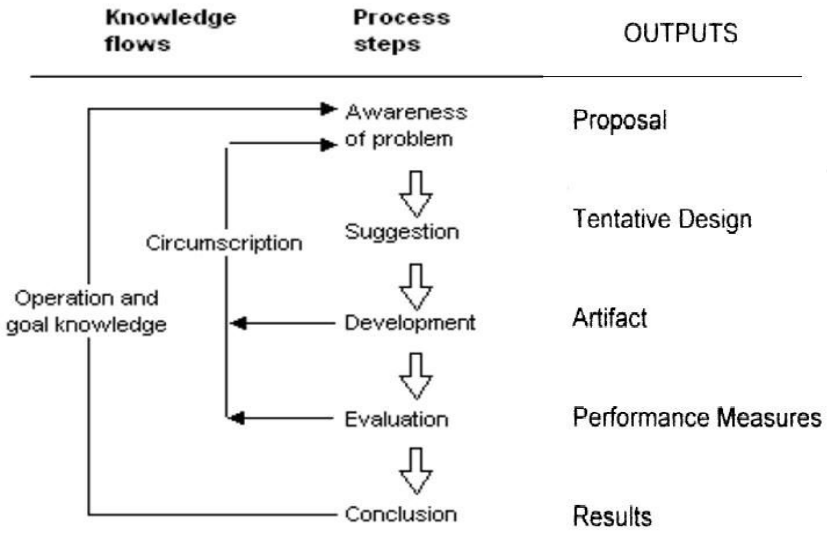

Figure 2: The General Methodology of Design Research. Vaishnavi and Kuechler (2004)

Awareness of Problem

This phase of the methodology was conducted through a series of meetings and surveys with the CAS management and the time tabling system users. These meetings initiate the development process by establishing a mutual understanding of the objectives, scope, user requirements and assess the feasibility of the development project.

A requirements survey was prepared for the respondents and to make it easier for them to provide the information we need in this research and to make the interviews more structured. The following details the respondents' answers to the survey:

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- All respondents agreed on that a web-based timetabling system will help CAS in enhancing the performance of the current timetabling process followed by CAS.
- Some of the respondents advised to follow the current process as it is with no modifications on the process itself and to use the current paper-based forms used in timetabling exactly.
- Some of the respondent suggested the use of usability testing in order to test the system's functionality and performance.

XI. SUGGESTION

Tentative design follows the proposal. The design of a requirements model for the system includes UML diagrams, and a sketch of the system's architecture. The UML diagrams involved are use case diagram, class diagram and sequence diagrams. The Rational Rose 2000 Enterprise Edition's software was chosen as a tool to view the diagrams which are use case diagrams, use case specifications and sequence diagrams and all of the system structure (See section 4).

XII. DEVELOPMENT

The system prototype was completely developed using .NET technology (2.0 .NET Framework) using VB.net as IDE. Microsoft SQL Server 2005 (the evaluation version) was used to build the prototype database to store all system related data such as staff, classes and resources data.

XIII. EVALUATION

The evaluation was performed to determine the level of functionality and operability of the system prototype after the prototype has been developed; it is tested based on the list of requirements in Table 4.1 for the system in the following chapter. The aim is to see the level of functionality and operability of the prototype system. The evaluation and its results can be seen as in Table 4.1 according to the system requirements.

XIV. CONCLUSION

This phase is the final step in research effort. The results were consolidated and the result for new problems awareness and suggestions for further research was recommended (See section 5).

XV. FINDINGS AND RESULTS

System Requirements

Based on the objectives and the definition of the Use Cases, the following are the requirements for this system.

Table 4.1: System Functional Requirements

Requirement	Description
Requirement1	The system should allow the college administration to add the Class Record
Requirement 2	The system should allow the college administration to update the Class Record
Requirement 3	The system should allow the college administration to view the Class Records in any semester
Requirement 4	The system should allow the college administration to Enter the Class Details to class Record

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Requirement 5	The system should allow the college administration to Enter class room requirements Details to his Record
Requirement 6	The system should allow the college administration to add new Room information Record.
Requirement 7	The system should allow the college administration to Edit the Room Record.
Requirement 8	The system should allow the college administration to Enter the room details to the room Record.
Requirement 9	The system should allow the college administration to generate the timetable
Requirement 10	The system should allow the college administration to save the timetable to the database
Requirement 11	The system should allow the college administration to Edit the timetable data stored in the database.

System Design

Tentative design follows the proposal. The design of the system includes UML diagrams, and a sketch of the system's architecture. The UML diagrams involved are use case diagram, class diagram and sequence diagrams.

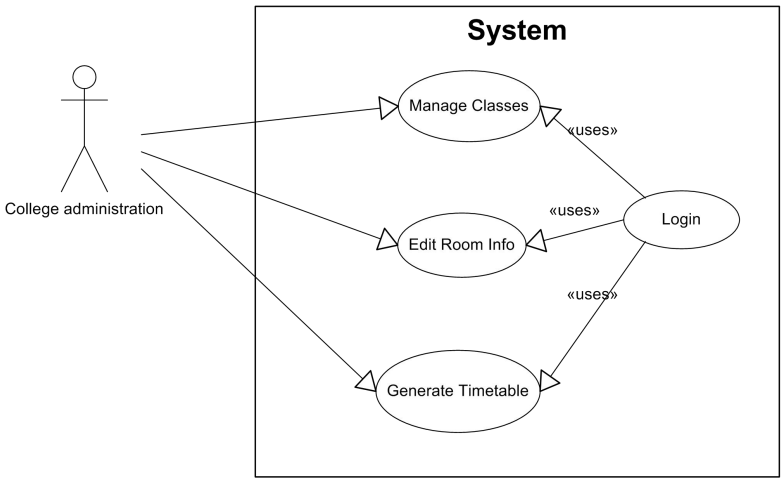

Figure 3: Main Use Case

The functionality of the college administration is the ability to interact with the system by managing the classes in any specified semester by adding or editing the class information, also the administration can Edit the room information, and the ability to generate a timetable of classes in a specified semester.

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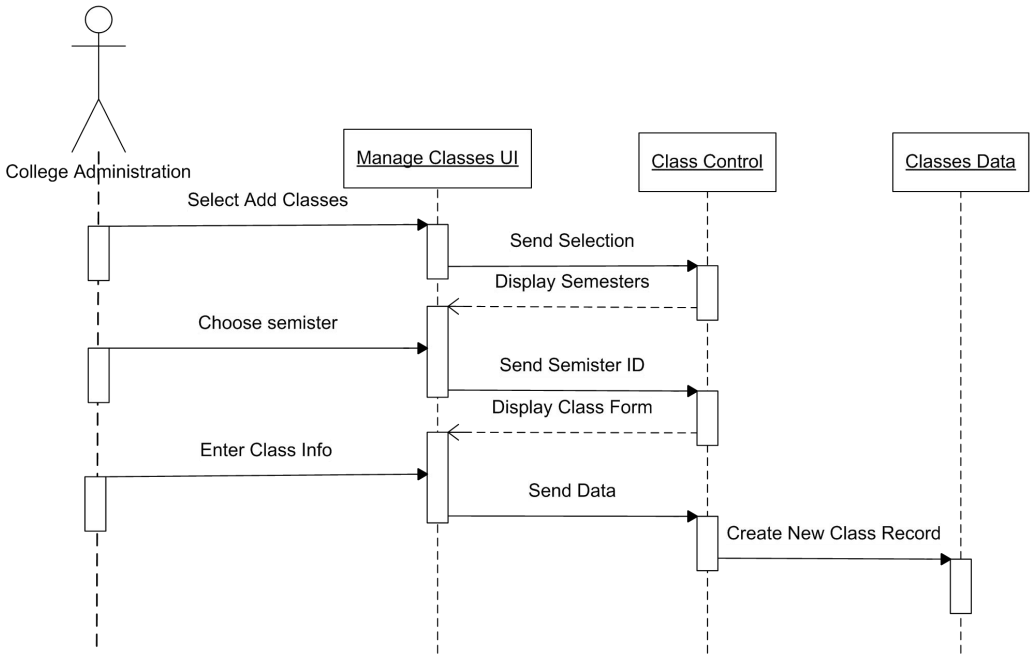

Figure 4: Manage classes Sequence Diagram.

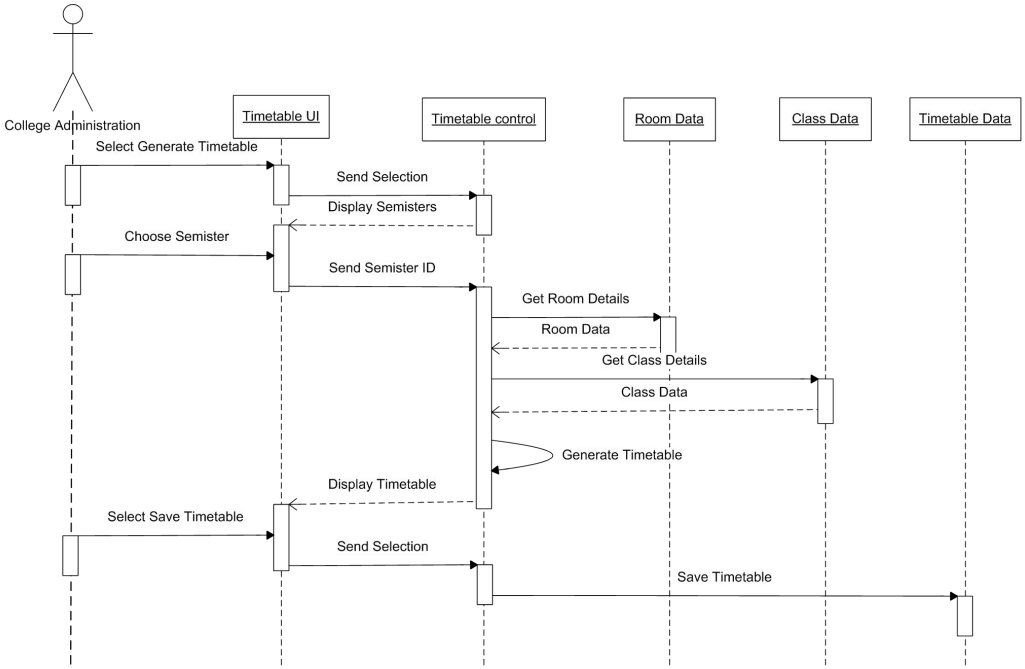

Figure 5: Generate Timetable Sequence Diagram.

XVI. SYSTEM ARCHITECTURE

For the system architecture, the three-tier architecture model is the best structure to use. Here is how the three-tier model is incorporated into the system.

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- **Tier 1:** This is the client side of the architecture. The user will be shown formatted HTML pages resulting from ASP.net code, which will be submitted to the application middleware for processing. It will actually be the front-end of the system and it is where the user will interact with the system.

- **Tier 2:** This is the middleware side of the architecture or the application tier. The main applications used in this layer are .NET Framework, which will be processed by a web server, i.e. Tomcat. Also in this tier will be the SSL protocol if it is exist, to make sure the system and data is secure from unauthorized users.

- **Tier 3:** This is the backend side of the architecture and where all the data and records are kept. Also known as the business data, the technology used store the business data is Microsoft SQL Sever 2005.

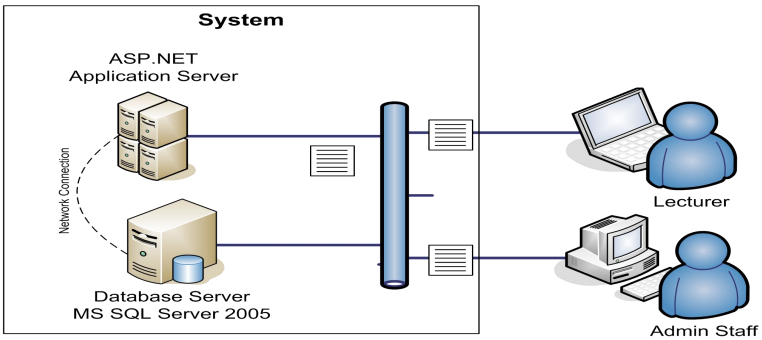
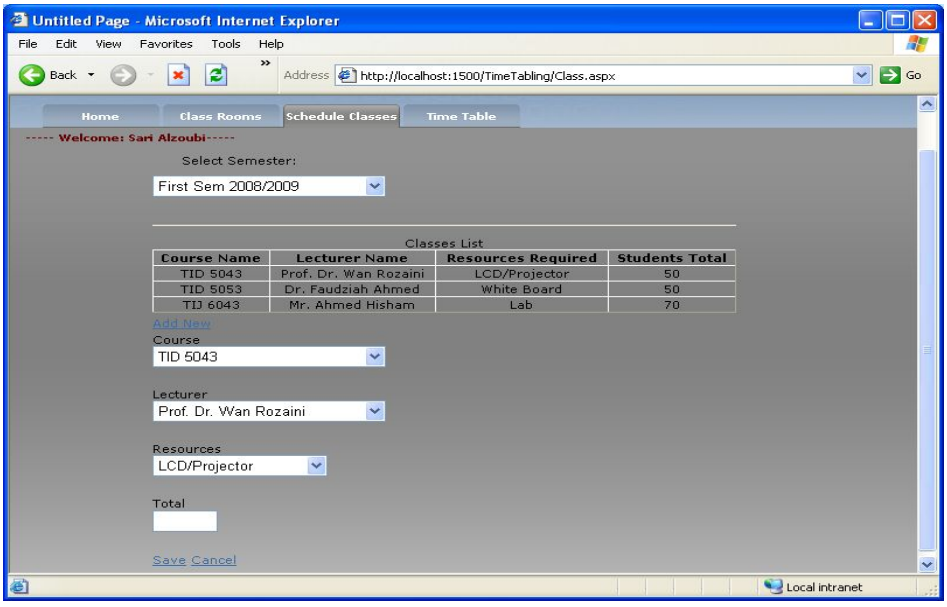


Figure 6: System Archeticture

XVII. TIMETABLING INTERFACE DESIGN

Schedule Classes Page 1.1.1



This page allows the user to add new class to the list of classes in the semester, the user has to enter all related information in the page and then click save to add the new class to the database.

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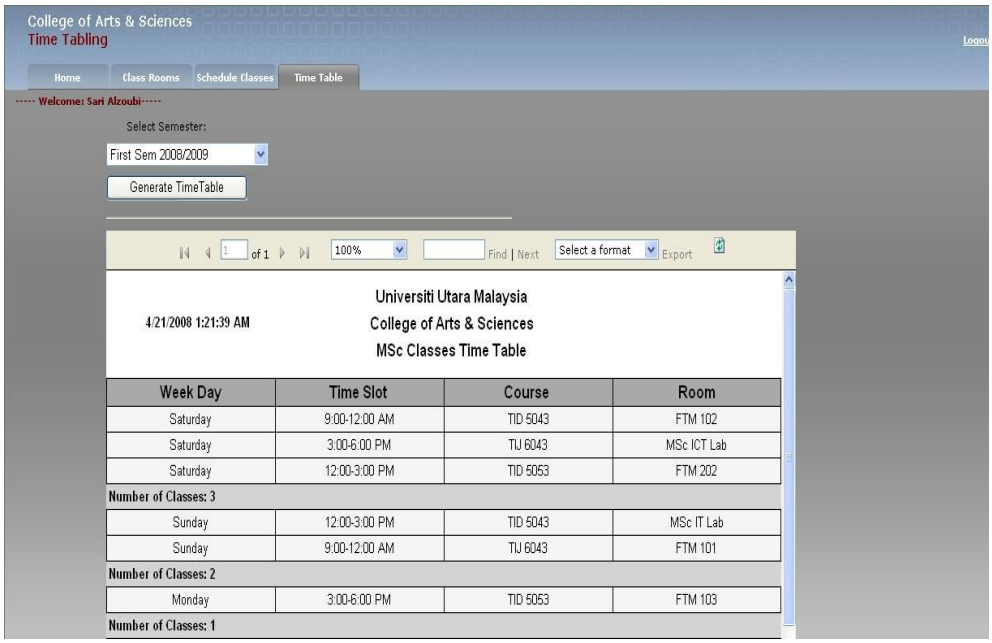
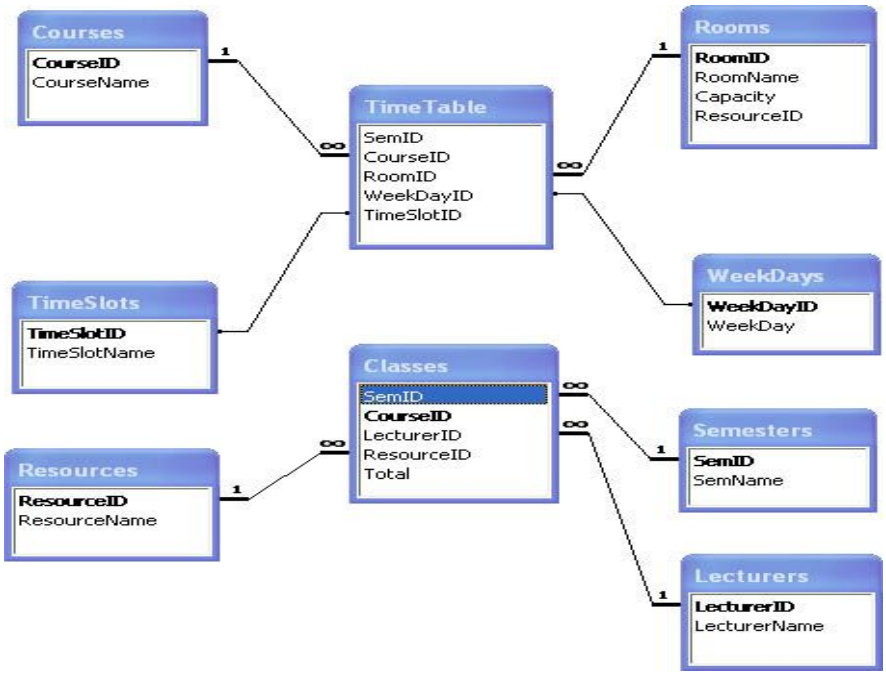
Time Table Page 2.1.1



This page is used by the college administration to generate the time table by choosing the semester and clicking the generate time table button the system will automatically generate the time table and display it to the user , the user can finally save the time table to the database.

Timetabling System Data Model 2.1



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The database schema shown in Figure reflects the actual hierarchy of the entities in the systems database. The main entities in the schema are the Timetable, Classes, and Rooms, the other tables are used mainly for lookup and login purposes.

XVIII. CONCLUSION

Problems and Limitations

This study has achieved its proposed objectives of building a web-based system for CAS timetabling. However, some problems and limitations revealed during and earlier to the development of the model as follow:

- This study handled the timetabling problem of CAS by generating the classes' timetable based on two variants only which are the class rooms' requirements of each class and based on the time line so it makes sure that no time or room conflict between the classes.
- The solution of this study is not dealing with the lecturers' allocation for courses since it takes it as requirement for generating the time tables. So in order to generate the time table the lecturers of the courses must be provided manually.
- The prototype's database is built using Microsoft Office Access 2003 so it may encounter some limitations during the deployment and real testing such as the security issues and the performance which not appear during the development.
- The prototype's database is a stand alone one and is not integrated with the UUM databases like the postgraduate school database and registration department that are already exist and this requires ensuring about the data consistency when storing or retrieving any data or performing any registration transaction.

XIX. RECOMMENDATIONS

Throughout the design and development of this prototype, several issues about its design and development were exposed. Future design and development in the same field of this study should take in their considerations the following recommendations and guidelines:

- This prototype should be developed farther to include in its variables list the lecturers' timetables so building the classes schedule or timetable should be based on four variables which are the rooms availability at all the classes timeslots, the resources required by each class must be available in the room booked for it, the classes timetable should has no time conflict between the classes and last building the timetable must take in consideration the timetable of each lecturer and his availability time to give the lecture or not.
- Another important development can be done to this prototype is to integrate it with an expert system for allocating the lecturers to the courses based on their qualifications, area of specialization and their experience in teaching the course. After this integration the system will be full automated and the CAS managerial stuff needs to do nothing but get the timetable ready for publishing.
- Another important consideration for future development and projects is to integrate this prototype database with the related university databases such as the Registration department and the postgraduate school to ensure the consistency of the data stored and retrieved from the system database and to make sure it's always up to date and to make the system more reliable.

XX. CONCLUSION

A web-based timetabling prototype was developed for College of Arts and Sciences of UUM in order to save time and effort for CAS staff in producing classes time tables every new semester and to make that difficult task easier and push up it performance since this task incorporating many variables to deal with and it usually faces many conflicts in time or locations of the classes.

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Implementing this prototype in CAS will return in many benefits for both the CAS staff management and academicians in one part and the students in the other part since they will have no problems during courses registration regarding time conflict or classes' capacity and other usual registration problems they face each semester. In addition the managerial staff will not face the usual problems of preparing the timetables for each semester and will stop receiving students complains about courses registration.

However some work and studies still need to be done to this system as described in the recommendations section in order to make the system reliable, up to date and converting the timetabling and classes scheduling process to a fully automated process by the system and to ensure the consistency of the data across all UUM related departments' databases.

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