Creating Relational Databases to Design Large Database Application System and Departmental Target Responsibility System

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ABSTRACT

This paper presents a practical outline to the mechanism of building a large database system through utilizing different programming languages. This is achieved by building a Relational Database Management System for the University of Sulimanya, in which they have a problem of inefficient database system. The research problem can be represented by creating and building a secure and efficient database system, as the commercially available package software are not appropriate to satisfy the demand of the large education organizations.

Performing the project and solving this research problem is achieved through two main steps. The first step is collecting data through interview technique and using the obtained data to requirement analysis of the system. The second step is writing the proper codes by using three different languages, namely, SQL Server, C# and Crystal Report for any of database background, interface and reports respectively.

The conclusion of this paper is not only preparing a reliable, safe, efficient and complete database system for the University of Sulimanya, but also drawing a theory and practical step by step guide for programmers in which clearly defines an approach to build any large database system through the mentioned programming languages.

Keywords: Database, Management Systems.

INTRODUCTION

Recording data of a vast number of students every year and all modules and libraries and employees and academic staff in a university need a complex system of database. Although many commercially available packages of software, such as a Microsoft access simple web page for this goal, can be used to manage and organize the database of universities or other institutes, the efficiency, effectiveness and capability of those software are limit in comparison to the universities demand. Moreover, the fact that each academic institute and university has its unique work platform leads to be required more efficient database system. The issues of security, speed and capacity and efficiency of the system are main issues which make those ready and prepared packages of software to not be useful in every case. This means using language programming to build unique database system for each university become a serious concern to guarantee a square, efficient and capable database system which can reply to the users of that system in the university internally or externally. This paper represents a project based work depends on an academic institute or university which is an intranet database system for the users in...
different levels; student, employee, tutors staff, library staff, department staff and administrators staff. This project was implemented based on (SQL server 2005) software. Due to the fact that this software is fast in responding and capacity of keeping a vast amount of data storage and transferring data to new information are the reasons behind selecting this software as a Database management system. The database management system consists of two parts: the database background, in which the Microsoft SQL server 2005 is used, and the interface; in which visual C# is used due to some reasons such as ease of use and ease of change in the program. Moreover, it is a new language of programming which also supports the object orient [1]. One more reason is that both visual C# and Microsoft SQL Server 2005 are based on the same family of Microsoft. They are used together to produce this Database management system.

With regard to the university and research method, the interview technique is used to collect data for users’ requirement and demand. Students, employees and tutors and administrators staff were interviewed to capture data through the Skype and telephone. While comments are put on the requirements and compared with the general rules of the universities basic requirements by benchmarking with the university of Nottingham. Although some other database management system such as Oracle and MySQL are available, we do not use them because Oracle is an expensive program [2] and MySQL is a web page based program which is more proper for programs such as PHP and ASP.NET rather than Microsoft programs family.

**REQUIREMENT ANALYSIS**

Sulimanya University has many different faculties and schools in which they require a complex system to manage the information and large database. The structure diagram of the university and different departments are considered to analyze the requirements. The nature of the university as all other universities is required to be analyzed according to schools and departments and various academic programs. For example the university consists of many schools and any of these schools is relevant to one university. Each school has many departments and any department of these schools is relevant to one school. Each school has many programs, for example any school run undergraduate BSc. MSc. and PhD programs for various subjects and any of these programs are run by various schools and departments. Each department has many professors and course directors and any of these professors teach in different programs and departments. Each program consists of different modules and any module might be shared in different programs. For example, MSc in operations management involves ten modules such as lean manufacturing, operations strategy, and managerial decision modelling. At the same time, lean manufacturing is a module which is shared in MSc programs such as supply chain management, manufacturing engineering, and aerospace engineering.

Each department has many students and any of these students enroll in different modules to obtain a certificate in a specific subject and departments has many professors and course directors and any of these professors teach in different programs and departments with student in same class maybe some professors have more than one modules in deferent department. Each program consists of different modules and any module might be shared in different programs

**System Characters**

This section discusses all the characters that are involved in the system or play a role in managing it as explained below:
The Head of University
This figure is in charge of the university and authorized to exercise his/her legal power in terms of appointing and replacing the deans, opening a new college, allotting a budget or employing staff. This character also distributes some power in order to accelerate things to be done.

Dean
This character that is in charge of colleges of the university has authority to appoint heads of departments and issues legal procedures for his/her college. This figure has been shared some power by the president of the university.

Head of department
This character that is in charge of the departments in the colleges makes and implements decisions in the departments. Further, it makes exam arrangements and determines the department’s levels.

Employee
This character includes all university working staff that works according their tasks required of them in different units of departments.

Student
This character involves those who come to university to study and achieve a certificate. It is required to meet different demands of the university such as completion of four years of study and their average degree should be not less than 50%. For those who study in the colleges of Engineering and Medicines, they should finish five and six years respectively.

Admin
This character is meant to be those who are authorized by the president of university to manage things related to database management system of the university. This will be through an expert committee tasked with supervising the system via the electronic system in cooperation with some other staff.

Agricultural Admin
This component has some shared administrative power to manage several works of agricultural college. For instance, it registers students’ names, inserts some specific information, and allocates time and place of the lectures.

University Board
This component is concerned with the university’s deans. Its function is to set necessary rules for the university.

Department Staff
This component involves all the follow-up committees tasked with implementing decisions made by the head of the departments.

Assignment progress
This component supervises the high-ranking committee that’s authorized to oversee implementing committees for several issues such as grades assignment marking, and revision.

Certification
This component is concerned with investigating items of data in the certificates. This is to ensure the validity of the information.

Classes
This component is specified to deal with issues relating to the class timetables so that the students tend to be aware of the time and locations of their lectures.

Departments
This component provides a summary on some matters relating to the departments and their staffs.

Exam
This category includes a summary on issues relating to time, location, supervisor and results of examination.
**Level**
This component provides information about students’ different levels of studies. It is also concerned with supplying departments with adequate teaching staff.

**Login**
This category allows different users to be able to login and logout in the system.

**Room**
This component offers information about lecture theatre halls

**Timetable**
This component contains a class time calendar of the whole academic year.

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**SYSTEM DESIGN**
In the previous section, all the necessary measures for building a reliable database system have been discussed. Accordingly, the purpose of this project is to use (SQL Server 2005) in establishing a database management system that fit with the demands of a university. The necessary stages taken into account in this study will be clarified as follows:

**Use Case**
This section presents the steps taken to build the database system with the support of (Use Case) which is considered to be one of the (UML object). This can assist other programmers and users of the system in understanding the basic and successive stages of creating the system.

**Entity-Relationship diagram (E-R diagram)**
After organizing all the obtained information from (Use Case) in a diagram, it is required to change it into another simplified diagram that could help shifting the information to the language of database which is known as (E-R diagram). Therefore, all the questions and answers appeared from (interview) should be changed to (scenarios); thereafter, the database should be set up accordingly. The database is explained below in two different parts: University library and central system.

**Library scenario**
There is a public library that belongs to the university where information on books and magazines are stored in two separate tables according to the authors’ names and (categories). Further, different sources with various editions belonging to the same author can also be stored properly. This is also the case for storing information on magazines. The library is managed according to a number of rules providing for the users visited and books kept. The rules make some discrimination between the types of users. For example, teachers unlike students are allowed to borrow books for longer times.

The library visitors can be classified into three classes: University teaching and administration staff as well as university students. All required information on each class is stored in a certain table including membership period and reference number. When a book return is delayed or lost, there is a particular table giving instruction about the penalty for any type of damage.

**University scenario**
It is a brief summary on the university’s database management system. This system can be defined as a large and complex one that is run in accordance with a number of rules for all the staff and those in charge of departments of the university starting from the president to the heads of departments.

All the information is stored and organized in a particular table, which can be divided into a number of branches. The first is comprised of some colleges, and each of them has its own information that can open departments and save their information in a separate table. The
The second part consists of the university board council that has a special table including the deans, and each staff has its own reference code.

The third section includes the table of information on the university president. The university has only one president and each one can be the president more than once, and all this information is stored in a separate table. Further, each college has its own dean, and all the required information is stored in a special table.

Each college has a table of information on its departments and their heads. Every department has special committee tasked with arranging exams and marking criteria of the students’ papers. For the heads of departments, there is a fixed table; each department includes some years of study. Each year of study encompasses a lot of modules; each module is taught by one or more teacher who each has his/her own special table.

Each department has a number of teaching and administration staff; the teachers unlike the employees are allowed to be part of more than one department. Additionally, they are able to teach in different departments, and they can have a paper.

The admin staffs have its own table in which certificates and all the necessary information on them are stored.

Each module has a specific table of information, and it is taught in a class and a specific time. Every module has assessment that is saved in a particular table, and each examination is supervised by a committee tasked with providing the requirements of the examination. The modules are also assessed based on assignments, which are managed by specialist committee and announced their results.

At the final year, every student should conduct a research study which is supervised by a lecturer and specialized committee. The results of exams are announced by an expert committee that also determine the time of makeup exam according to a time table.

After a student is offered a place at the university, he/she is got registered in their college and department according to a particular system. The student is then given a registration number, account number, password and email account. This can be done through two subsequent tables. Following being got registered, the student is allowed to choose modules from different optional ones at the first year.

All the information is then stored in a table called ‘Class’. The unattended students at class are named absentees. The students also should enter their addresses and upload their photos through two subsequent tables. The students are allowed to take part in the library’s activities through providing them with a number. They also must carry out a research project under the supervision of a lecturer. After finishing each year, they are allowed to access their marks and print out their certificates of transcripts from the system.

University Visualizations

Many characters have involved and contributed in running or controlling the database system. The highest level of authority in the university is the Head of University. Deans come after and appoints departments’ heads and legal procedures in the college. Decisions implementation in the departments, such as exam arrangements is Head of Department responsibility. All university working staff their tasks in different units of departments called Employee. Students are university customers to achieve a certificate and their responsibility is meeting different demands such as achieving at least 50% with six years class attendance for Medicines, five years for Engineering and four years for other colleges. The president of university will authorize an expert committee some staff to manage the university database management system called Admin. For example, tasks such as students’
names registration, inserting some information, and lectures time and place allocation would be performed by the authorized person in the agricultural college called Agricultural Admin. The University Board consists of deans of colleges, as an administration board, which are responsible for setting necessary rules for the university functions. The department heads decisions will be implemented by follow-up committees called Department Staff. To progresses evaluate through supervision marking revising of assignment, and controlling the disobeying the university rules under Assignment progress.

Certification is a sensitive part in terms of data validation assurance. Classes are used to consider class timetables problems in order to enable students to commit their lectures time and place. Data regarding some problems such as staff employment is provided and summarized by Departments. Relevant concern regarding exams supervisors, time, location, and results is dealt with under Exam. Level provides relevant data to students’ different levels of studies and enough teaching staff to the department. To enable different users to login and logout in the system the category of Login is used. Lecture halls relevant information is covered through Room. Timetable organizes the whole academic year calendar timetable.

PROGRAMMING
As mentioned earlier, selecting VC# as one of the most powerful programming software that can support (OOP) types is due to the reason that our database belongs to the Microsoft family. For these reasons, the interface creation of our database is implemented using this program; below are some examples.

Form1: this is the first form of our program and with running the program this form is opened. Working on this form consists of whether you login as a member of the university or as a guest. The university member user can perform some specific activities. While guest users cannot make any changes or perform any activity. See figure 1.

Address: In this form the employees and students’ addresses are entered. Appointed and specific employees perform this task and input data. The students and employees can see their data and can make change or update their own data. See figure 2 of users Address Form.

Admin: this form is specific for the admin and only the admin can login to this page. Moreover, all other forms exist in this page and can be controlled. In other words, the full authority of accessing the entire system is permitted to the admin. However, this authority is divided between the numbers of other parts to make it easy and fast to manage the university’s processes. See figure 3.
Student form: this form is special to the data of students. Each student is given their own username and password in which they use login. Moreover, students can change their address and other credentials, relevant data to the modules they select to take during their course, and to upload and change their photo. See figure 4.

Teaching form: this is specified to teaching staff in which tutors can see their information and all relevant data to their work, see figure 5.

Employees form: this form is private to the employees and they can use it to update their own data after logging in through their own usernames and passwords. See figure 6.

Assignment-Progress: This form is specified to data regarding the assignments written by students and is managed and controlled by a specific staff. See figure 7.

Certification form: the employee’s certificates and degree they have are stored in this form. See figure 8.
**Classes:** this form involves all information about modules taken by students and taught by professors, where halls and times are determined see figure 9.

**Employees:** relevant information and data to the entire employees are uploaded through this form. See figure 10.

**Exam:** this page has the relevant data and information to the exams, where time and place of the exams are entered. See figure 11.

**Images:** controlling and entering images of all employees and students is performed here. See figure 12.

**Login:** here all other forms are used by staff members and students through the access code or the password they are given to use. See figure 13.

**Crystal Reports:** This part is one of the scopes that are used to present and show the information in an acceptable and understood
manner. Reports in this system have a significant and crucial role for preparing and presenting marks or any other information which exist and required to be shown.

**Attendance-Cvp-mid-1:** this report is private to the absent students in the first grade of Medicine College. Similarly, other grades and schools have their report, with the different in the identity code. For example, Attendance-Cvp-Agr-2 is the report that involves the information regarding the absentees of the second grade of medicine college students. See figure 14.

**DepartmentCrP:** this is the report in which information of different departments of the university are shown. See figure 15.

### METHODOLOGY

This section covers the methodology and data collection methods and techniques for this project. The aim of this project is to redesign the ER-Diagram of the institution and to build new and appropriate database software to increase the security and efficiency of the system in terms of information management. This is adjusted by looking at the work as a software project management.

With regard to project management steps, two different types of projects exist and each requires its own methods to be managed. However, in both cases various resources of materials and human powers and skills or knowledge must be specified and organized along the timeline of the project. The engineering projects can be managed by the sequence approaches and Gant chart. While software projects are unique cases and have many characteristics that must be considered. This database management system is not exactly a software project; it is a system developing project to fulfil an educational organization’s requirement to management information system software.

Such projects should be started with collecting the required data from the client which is Computer Science Institute of Sulimanya. Many approaches can be used to collect data such as survey and interview, or using the organizational structure of the institute with the typical systems of similar educational institutes. However, as a Human–computer Interaction (HCI) project, the best way is interviewing the users of the system with considering the typical requirements of any similar organizations [3]. In this project, interview and database system benchmarking is used as tools to collect data.

**Data collection**

Users can be considered as the main resource for capturing data regarding the features and components of any software system. Their feedback and requirement for the specific
functions and design must be taken into consideration. The significant point here is that how to know the users demand from the system? As mentioned in the previous section, survey and interview method can be used to capture data from the users. For the aim of this project the individual interview method is used rather than survey. This is due to the fact that survey is useful to collect broad data rather than deep data. In other words not all details can be known from surveys as the repliers do not reply to the long questions, while in the interviews more deep information regarding the system can be gained.

In survey method more users can contribute to provide data. However, the limitation of the questions that can be asked makes this approach less reliable to build a system. This results in distributing a big number of questionnaires and asking more question. In interview method, the participants are less and their quality can be chosen. In other words, as far as a little number of users is used to be interviewed, most knowledgeable persons can be selected and more questions can be asked. Consequently, deeper information can be gained and precisely the user’s requirement can be understood to a large extent.

For this project, five types of users are interviewed: administration staff members, tutors, employees, and finally students. The interviews have been performed through Skype and Telephone. A list of question has been used to capture the required data regarding the demand of any type of those mentioned users. The data then analyzed and combined with the typical structures of any similar institute. The interview approach has also some drawbacks such as the problem of selecting the interviewees and the questions that are asked. In addition, the focus group approach was difficult for this project in which yields in brainstorming and more discussion between different types of users [3].

The other approach of collecting data is using benchmarking typical database system. In other words, any educational organization must have some specific features for their database management system. For example the University of Nottingham DBMS is used as a benchmark for recognizing and designing the system with considering the gained data from user’s interviews.

**DISCUSSIONS**

In this project, a large system has been built by using the RDMS. Therefore, several results have been obtained in which are explained as follows:

The ease of using the system by the users which yields in consuming less lead time in learning how to use it. Consequently, the overall cost of education process of the university would be cut.

Security: the avoidance of problems such as loosing data or hacking and stealing data problems by external and non-permitted persons is one of the pros of this system.

In this project the technique of interview has been used to collect and gain appropriate data from the users and client in order to create and build a large and professional system in accordance with their demand and requirement. There are many ways and techniques for collecting useful data to recognize what the users want exactly from the system. Some examples are questionnaire, observation and interview. However, the best way for the human computer systems, either hardware part or software part, might be the interview.

Another significant feature to have information on the extent of succeeding and reliability of the database can be known from the customers’ feedback after they test the performance of the software or the database system. In this project we have selected some samples from each type of the three users, namely, academic staff, administration staff and the students.

We gave username and password to each user and they were asked to use the system in accordance to their job and provide feedback.
Regarding the pros and cons of the database system. The results of the feedback analysis lead us to state that the database system is reliable to a large extent and can fulfil most, if not all, of the users requirement and can adapt the university system.

In this project it was proven that through implementing and managing the database system of any organization can be achieved by using some specific program, namely, C#, SQL Server, and Crystal report. It is also possible to change a small single user program to a large professional multi-user database program as we have done in this project.

CONCLUSIONS

In conclusion, after using three different programs, namely (SQL Server 2005, C#, Crystal Report) to build a large system such as a university information system, and after running the program as an integrated package, it appeared that implementing and utilizing the RELATIONAL DATABASE MANAGEMENT SYSTEM (RDBMS) is reliable for a broad education system not only in terms of efficiency but also in terms of security.

The significance of this database built in this research is that it has effectively helped with storing and regaining information from the university under study on the basis of (RDBMS). Based on the outcomes of this study, it is concluded that information can be received and added very quickly and efficiently. In addition, the information on many users can be updated easily and effectively. What has made it possible is the application of Visual C# and SQL Server 2005. Moreover, the information can be analyzed through the employment of crystal report, which is the most sustainable program of reports.

This study argues that the software packages and database programs available in the market of information technology are incapable of addressing all the issues may confront the users of such programs. This is probably due to the fact that they have not been built according to the needs of a particular context. Instead, they have been produced to be used generally in every context. Addressing this limit, comments obtained from interviews held with the users have been used to design the system.

Despite the high efficiency of SQL Server 2005 in terms of security, the information used in this study was further strengthened by Visual C#. Another conclusion can be drawn from this study is that RELATIONAL DATABASE MANAGEMENT SYSTEM has a remarkable compatibility with Object oriented programming by using Visual C# and with the support of OOP. Therefore, it might be argued that the application of RELATIONAL DATABASE MANAGEMENT SYSTEM for producing large database systems is more time efficient and effective for the users.

REFERENCES

