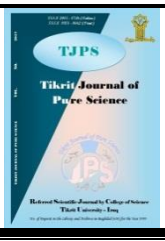
Tikrit Journal of Pure Science (2023) 28 (5):182-192
Doi: https://doi.org/10.25130/tjps.v28i5.1291

TJPS

IASJ
المجلات الاكاديمية العراقية

Tikrit Journal of Pure Science
ISSN: 1813 – 1662 (Print) --- E-ISSN: 2415 – 1726 (Online)

Journal Homepage: http://tjps.tu.edu.iq/index.php/j



Design and Implementation of an Online Electronic Platform to Manage Education Activities in the Computer Science Department at Mosul University

Ali Modhar Yahiya[1], Ammar Thaher Yaseen[2]

[1,2]Computer Science Department, College of Computer Science and Mathematics, University of Mosul, Mosul, Iraq

Keywords: Database, DBMS, Education Activities, SQL Server, Electronic Platforms.

ARTICLEINFO.

Article history:

-Received:	**22 Feb. 2023**
-Received in revised form:	**20 Mar. 2023**
-Accepted:	**24 Mar. 2023**
-Final Proofreading:	**24 Oct. 2023**
-Available online:	**25 Oct. 2023**

Corresponding Author*:
Ali Modhar Yahiya
alimodharcs@gmail.com

ABSTRACT

In this work, data for electronic activities of lecturers in Computer Science Department was organized using a relational database management system to exploit relations between entities for facilitating access, view, and manipulation of data developed using Microsoft Visual C# programming language to obtain an easy-to-use graphical user interface (GUI). In addition, the Sap Crystal Report program was used to prepare reports for the electronic activities of the lecturers under study. The electronic system would reduce mistakes caused in the manual use of lecturers' data. Additionally, it would speed up data access in case of viewing, updating or deleting the data without any errors. This project consisted of four phases, namely, system analysis, design, implementation and evaluation. Experiments explained that the suggested database system is more appropriate for lecturers' information management, as more than 80% of the lecturers studied were satisfied with this project. This type of on-line platform system and its applications can be applied for stakeholders in various ways.

Tikrit Journal of Pure Science (2023) 28 (5):182-192
Doi: https://doi.org/10.25130/tjps.v28i5.1291

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تصميم وتنفيذ منصة الكترونية آنية لإدارة النشاطات الالكترونية في قسم علوم الحاسوب في جامعة الموصل

علي مضر يحيى[1]، عمار ظاهر ياسين[2]

[2،1] قسم علوم الحاسوب / كلية علوم الحاسوب والرياضيات / جامعة الموصل / الموصل – العراق

الملخص

في هذا العمل، يتم تنظيم بيانات الأنشطة الإلكترونية للتدريسيين في قسم علوم الحاسوب باستخدام نظام إدارة قواعد البيانات العلائقية لاستغلال العلاقات بين الكيانات لتسهيل الوصول إلى البيانات وعرضها ومعالجتها، والتي تم تطويرها باستخدام لغة البرمجة Microsoft Visual C# للحصول على واجهات رسومية سهلة وبسيطة. كما تم استخدام برنامج (Sap Crystal Report) لإعداد تقارير للأنشطة الإلكترونية لأساتذة قسم علوم الحاسوب. يقلل النظام الإلكتروني المقترح من الأخطاء الناتجة عن الاستخدام اليدوي لبيانات التدريسيين. وكذلك يوفر السرعة في الوصول إلى البيانات في حال أردنا عرضها أو تغييرها أو حذفها دون أي اخطاء. يتكون هذا المشروع من أربع مراحل هي تحليل وتصميم وتنفيذ وتقييم النظام. وضحت التجارب ان نظام قاعدة البيانات المقترح مناسب بشكل أكثر لإدارة معلومات الأساتذة. بحيث ان أكثر من 80% بالمائة من عينة الاساتذة التي تم اختبارها راضين عن النظام المقترح. هذا النوع من منصات الأنظمة وتطبيقاتها ممكن تنفيذها على المحاضرين بعدة طرائق مختلفة.

الكلمات المفتاحية: *قواعد البيانات، DBMS، النشاطات التعليمية، SQL Server، المنصات الالكترونية.*

1. INTRODUCTION

As a result of the wide spread of modern means of communication, the concept of electronic activities (E-Activity) has appeared. This concept refers to education using modern means of communication, such as computer and Internet, along with media, such as sound, image and video. With less time and effort, the education process is carried out through the Internet, which provides a greater opportunity for a larger number of learners. One of the most important features of E-activity is the ability to manage the lecturer's activities [1, 2].

The process of storing and retrieving data has been a necessity in all businesses. The term "data" can be defined as any instance that holds an explicit or implicit information. Data can take different forms, such as text, number, image, etc., for example (Ali, 38, student) is data. When data is processed and converted into meaningful and useful form, it is known as information. For example, (Ali is 38 years old and a student with a high diploma) is the information deduced from that data. The fast access to information is vital because important decisions are based on the information available at any given time. Traditionally, data is stored in large repositories, such as physical files, books, folders, and archives. However, storing data and retrieving information from repositories was a time-consuming task. With the development of the computer, the problem of information storage and retrieval was solved. A single computer replaced a ton of paper, files, folders, and archives as the principal media for storing important information. A database is a framework for storing and efficiently accessing and manipulating data. It depends on a special program named database management system (DBMS) [3, 4].

In fact, database systems have the feature of storing and retrieving data easily, as well as the ease of updating or deleting the data, and reducing errors that may occur, such as redundancy and inconsistency in the data [5, 6]. Therefore, this research mainly aims to facilitate the work of the employee in the Department of Computer Science through using the project of database system. This system can store staff's information, students' information, information on activities that take place within the department, the type of the electronic activities (video, audio, txt file, or image),

as well as course information and date of the course for each lecturer. In this system, the tables are created, analysed, designed, and relationships between the tables are made. These tables are linked with GUIs in order to make it easy for the user to deal with the program and obtain data related to E-activities.

There are several tools used in this research, such as Microsoft Visual Studio C# language, which is considered one of the important languages, as it runs under Windows environment. It supports the creation of applications on multiple environments, such as Linux and other environments. It is also considered a very powerful development language, with a very high compatibility with Structured Query Language (SQL) Server language. SQL Server language, is a non-procedural informational programming language for relational databases in terms of managing and dealing with them. Thus, this work is done under windows environment. The SAP Crystal Report program is also used in the project to obtain reports, as it is considered one of the important programs in preparing reports in the project [7, 8].

This project is designed to be applied to the Department of Computer Science, College of Computer Science and Mathematics, Mosul University. The project can also be used in all departments of this college and other colleges after making the suitable adjustments to it. This project could be used in all Iraqi universities after its success is proved in the departments of Mosul University.

2. Related Works

There is a large number of open source and proprietary electronic-activity platforms that any educational institution can accept. These platforms allow the integration of custom modules to meet the personal requirements of educational institutions or organizations [8]. Higher education institutions in Malaysia and other countries have developed various Learning Management Systems (LMSs) as a medium for learning and interactive online management. LMSs also facilitate communication between the lecturer and the institutions. Some examples of LMS are Moodle, MyGuru2, and Blackboard [9, 10]. LMS technology has developed over time, and various types of LMSs have been introduced, such as Sistem Maklumat Sumber Manusia (HRIS), and Perancangan Sumber Perusahaan (ERP). Both systems can be used to analyze differences in lecturers' performance, and also for competency evaluation [11].

Liu, Natalya and Elena [9] state that the use of such platforms facilitates dealing with the electronic activities of lecturers and students at the same time. Cabero, Maria and Annachiarra [5] add that the use of these platforms is suitable for lectures and students to carry out collaborative activities and incorporate them successfully. Karaliva [11] indicates that in recent years, the number of electronic activity systems has increased, but lecturers are still not motivated to use them. This requires developing new conceptual models of training and communication software.

Accordingly, this study aims at:

- Managing the activities of lecturers in the Department of Computer Science and getting a report about electronic activity type (e.g., video, audio, images, txt file) of specific lecturer.
- Saving data for both the lecturers and the students without the problems of redundancy or irregularity in data.
- Fast accessing to data by using database systems in the project.

Therefore, the lecturers can control lectures at any time that suits them in order to manage and organize the work without the need to go to their working place and can easily access to information of lecturer's activities.

3. Research Methodology

This work was conducted by following these (9) steps:

1- **System analysis:** In this stage, the system was analyzed in order to know the objectives and purposes of the project, the process of data collection, the inputs, processing and the output for them. This stage showed data collection, user requirement, and procedure requirements.

2- **Identification of entities:** This stage identified the entities and their properties and put them in a standard form. The names of the entities were carefully chosen to avoid problems during the design of the project. Thus, eight entities were created, namely, LECTURERS, ACTIVITY, COURSE, UNIVERSITY, DEPARTMENT, COLLEGE, STUDENT, and CLASS.

3- **ER_DIAGRAM:** This stage described the entities for the system by drawing flowcharts. At this point, the structure of the database was described by means of a diagram called (ER-DIAGRAM).

4- **Cardinality:** In this stage, the entities were linked to each other by relationships, applying the cardinality to the relationships of entity.

5- **Relational model:** In this stage, models of relationships between entities were designed to inherit the data. In other words, relational model for the ER Diagram was designed.

6- **Normalization:** In this stage, the database was normalized on the relational model to obtain a consistent database free of duplication. This means applying the normalization to the relational model to reach the Third Normal Form (3NF). This stage resulted in designing a database free of redundancy and distortions in the data.

7- **Creation of database and tables:** In this stage, the database and tables were created using a database management system SQL Server.

8- **Designing GUIs:** In this stage, the interfaces for the program were created using Microsoft Visual C#, so it became easy to use by the user, as the interfaces enabled the user to either enter, retrieve, update, or delete the data.

9- **Evaluation:** In this stage, the system was evaluated using a questionnaire.

4. SYSTEM ANALYSIS

This section was divided into two parts. The first part included the analysis tools used in analyzing the system. As for the second part, it included the results of using the analysis tools mentioned in the first part, including the Entity Relationship ER Diagram as well as the Relational Model RM.

4.1 About the System

4.1.1 System Analysis

System analysis consisted of some basic steps as follows:

A. Goals behind Designing the System

Since it is necessary for the designer to know the goal of the project, thus this study aimed at facilitating electronic activities management for the lecturers in Computer Science Department through storing the information of the activities in order to simplify user's access to that information.

B. Data Gathering

In this stage, the data was collected for the project and the forms were obtained for the electronic activities of the lecturer. Based

on the data obtained in this form, the system was designed. The data was provided by the Department of Computer Science, Mosul University, containing information about the lecturers (their names and scientific title). After that, some lecturers in the department were visited to seek more information on how to manage electronic activities in the department.

C. Input and Output of the System

The input of the system was represented by the data on the lecturers and the students, while its output was represented by reports about the activities.

4.1.2 Identification of Entities

The second stage of the project was the formation of the entities, representing an important stage in terms of designing the project; therefore, the names of tables and properties should be carefully chosen to avoid problems.

4.1.3 ER-Diagram (Entity Relationship Diagram)

The process of describing the structure of the database with the help of the schematic diagram is called ER-Diagram Design. The reporting model to be generated and its diagram was the schema for the ER-Diagram database. The main components of the ER-Diagram model consisted of a set of entities and relationships between these entities. The ER-Diagram showed the relationships between similar entities, containing characteristics in terms of DBMS. The ER-Diagram showed the complete logical structure of the system [12].

4.1.4 Normalization

Normalization is a technique of reducing redundancy when designing databases and removing distortions and unwanted characteristics. It divides the larger tables into smaller tables and then links them through relationships. The purpose of normalization is to get rid of redundant data (redundancy) and verify the data logically. In short, the normalization process is the production of a database that is cost-effective and has greater security models [13]. Database normalization forms include: First Normal Form (1NF), Second Normal Form (2NF), and Third Normal Form (3NF).

4.2 The System's ER-Diagram

After gathering the information about the project, eight entities with their attributes were identified as follows: Class, Course, Lecturer, University, College, Department, Student, and Activity. After that, these entities were linked via relationships. The system's diagram was drawn according to the rules of the ER Diagram and the rules of modality and cardinality constraints. Figure (1) shows the entity diagram of the system.

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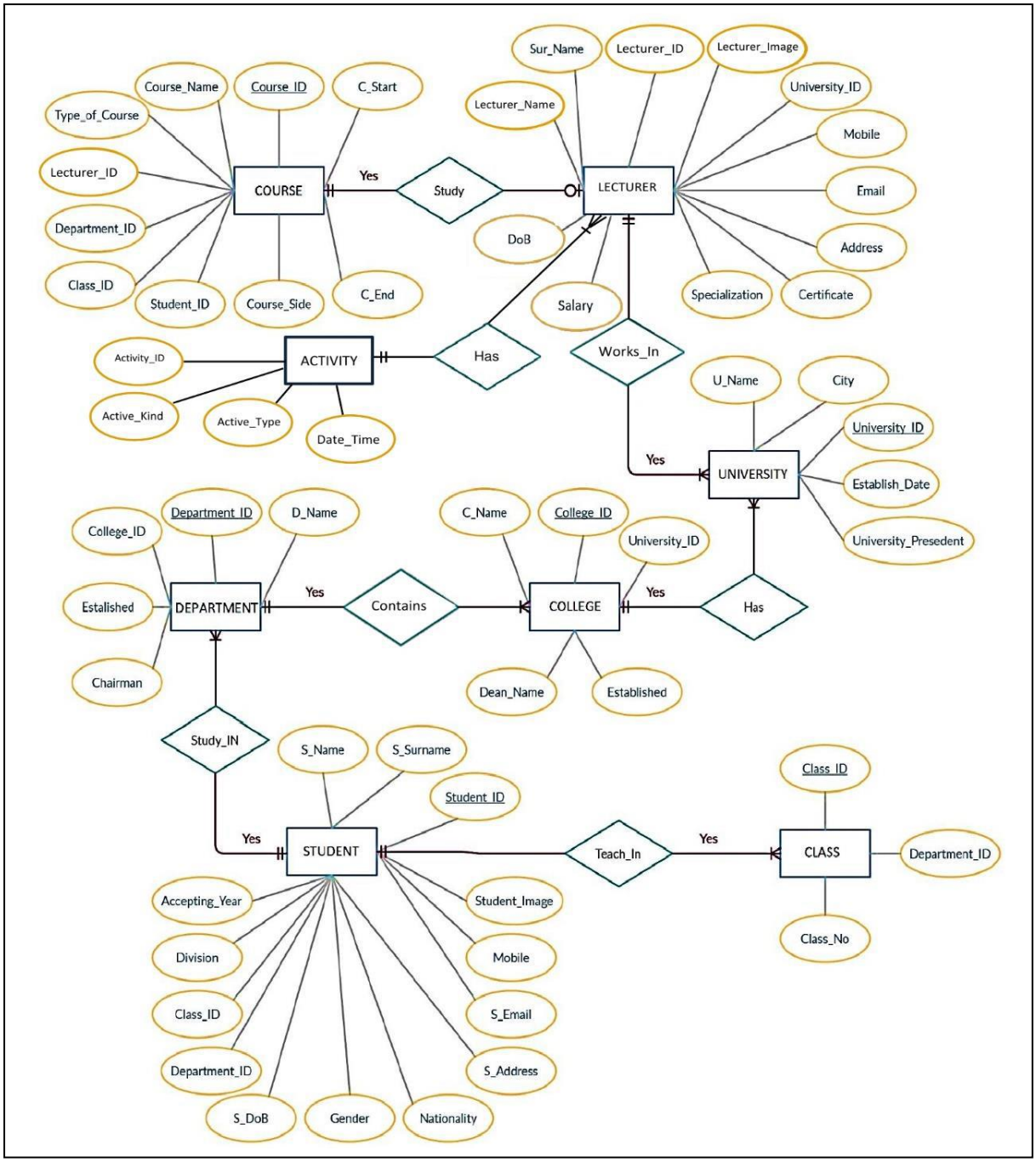

Figure 1. ER-Diagram of the system

4.3 Relational Model

Relational model is a fundamental mathematical basis for SQL databases. It consists of relational algebra, calculus, and a structured query language (SQL) that balances the theoretical implementation and systems design aspects of databases. Briefly, relational model represents how data is stored in the database in the form of table [14, 15].

4.4 System's Data Flow Diagram

To summarize the analysis and design of the system, a general data flow diagram was presented (see Figure 2). This flow diagram consisted of three main steps: 1) the data entering process; 2) system manipulation

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process which is responsible of saving, indexing, and retrieving the information; and 3) the outputs of all queries that the users requested.

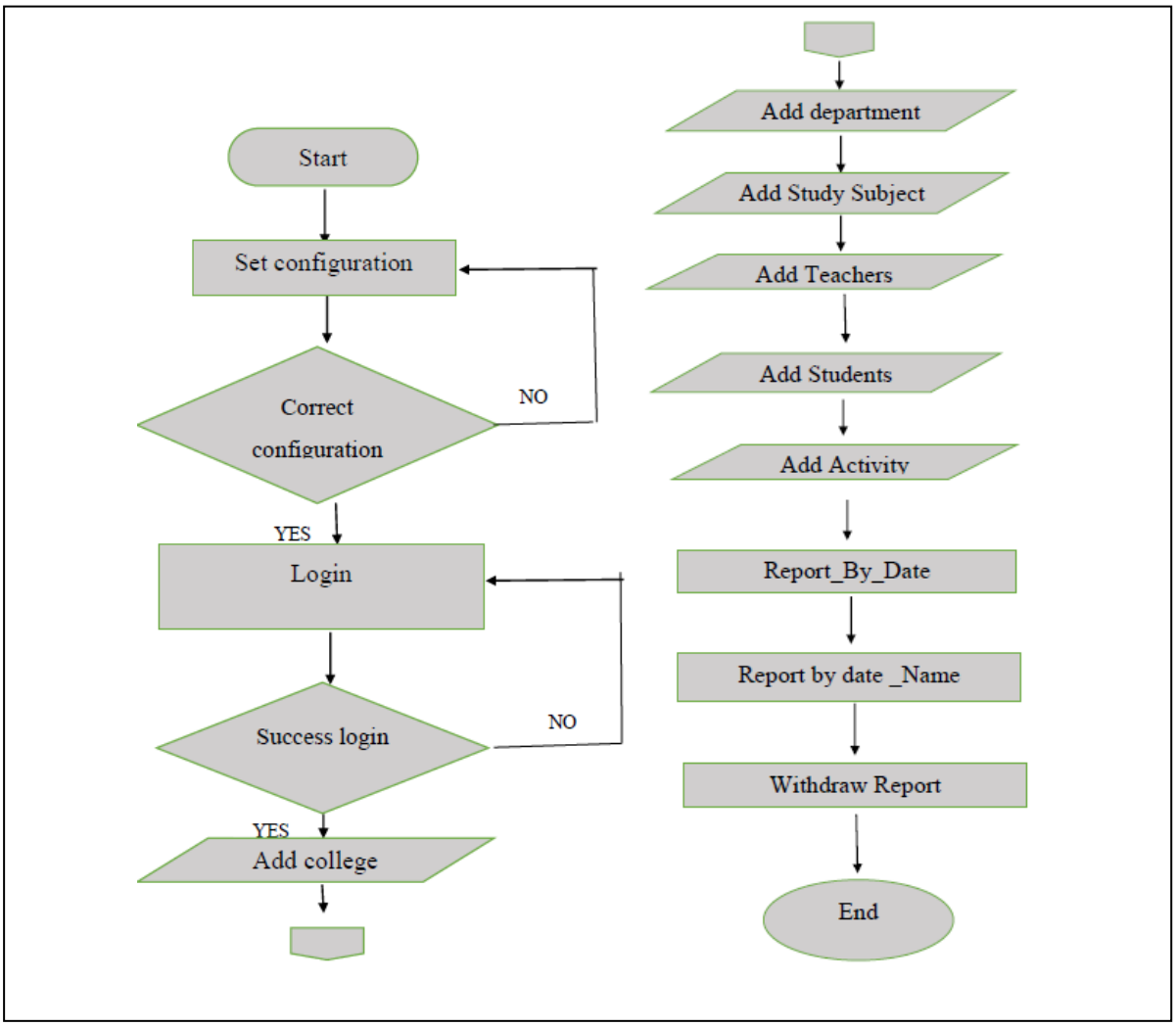

Figure 2. Dataflow Diagram

5. System Implementation

In this section, the project interfaces and functions implementation methods were discussed along with explanation on each part in the project. Required programs with suitable versions setup and configuration were discussed briefly. Examples concerning system's functions and interfaces were shown in the figures of this section.

This section consisted of two parts, namely, System Configuration and System Development. The section of System Configuration covered the program's installations and the necessary additional programs, namely: Microsoft SQL Server, Microsoft Visual Studio, SAP Crystal Report, and Microsoft .Net Framework.

As for the section of System Development, it explained the system instructions, such as the instructions for connecting to the database using the SQL connection () function, where the program links with the database to be dealt with by the graphic interface designed, as well as other functions, such as open (), close () and execute Command ().

This project was designed by computer with these specifications: Intel ®cori7 CPU 2.8 Ghz, memory:8192MB RAM, on WINDOWS 10 environment.

Functions and Procedures

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This section explained the basic functions and procedures through which this project was implemented. Generally, most applications with databases were implemented with the help of these functions:

1. SQL connection function

SQL connection function was used to link the database in (Microsoft SQL Server) with interfaces designed by language (C #) and the environment (Microsoft visual studio) in order to exchange data between the two parties. This function was used in the server connection setting form, as mentioned in the List 1.

2. Open () procedure

This procedure was responsible for the process of opening the database. As every connection to the database, the system required a function to open the database in order to interact with it. This procedure was used in all forms, as shown in the List 2.

3. Close () procedure

This procedure was responsible for closing the connection with the database, as the database must be closed after the completion of its use. This procedure was used in all forms, as shown in the List 3.

4. Select data () function

This function was responsible for reading from the database. It was used in the forms of teacher management and student management, as shown in the List 4.

5. Execute command () procedure

This procedure was one of the most important functions of this project. It was used to add, update, and delete from the database. This procedure was used in Add College, Add Department, Add Study Subject, Add Teacher, Add Student, Add Activity, as shown in the List 5.

5.1 Server Connection Setup

The program settings must be adjusted in order to connect the database located in the Microsoft SQL Server with the interfaces designed using the C# language on the Microsoft Visual Studio platform in order to exchange data between the database and the system interfaces. This step was performed by clicking on the server connection setting button. After that, the name of the server was chosen according to the server's name during the installation process of the Microsoft SQL Server program.

```
{
    sqlconnection = new SqlConnection(@"server=" +
      Properties.Settings.Default.Server +
      ";Database=" +
      Properties.Settings.Default.Database + ";
      integrated security=false; User ID=" +
      Properties.Settings.Default.ID + "; Password="+
      Properties.Settings.Default.Password +"");
}
else
{
    sqlconnection = new SqlConnection(@"server="+
      Properties.Settings.Default.Server +
      ";Database=" +
      Properties.Settings.Default.Database +";
      integrated security=true;");
```

List 1. SQL connection ()

```
//Method to open the connection
public void Open()
{
    if (sqlconnection.State != ConnectionState.Open)
    {
        sqlconnection.Open();
    }
}
```

List 2. Open ()

```
//Method to close the connection
public void close()
{
    if (sqlconnection.State == ConnectionState.Open)
    {
        sqlconnection.Close();
    }
}
```

List 3. Close ()

```
//Method To Read Data from DataBase
public DataTable SelectData(string stored_procedure,
SqlParameter[] param)
{
    SqlCommand sqlcmd = new SqlCommand();
    sqlcmd.CommandType = CommandType.StoredProcedure;
    sqlcmd.CommandText = stored_procedure;
    sqlcmd.Connection = sqlconnection;
    if (param != null)
    {
        for (int i = 0; i < param.Length; i++)
        {
            sqlcmd.Parameters.Add(param[i]);
        }
    }
    SqlDataAdapter da = new SqlDataAdapter(sqlcmd);
    DataTable dt = new DataTable();
    da.Fill(dt);
    return dt;
}
```

List 4. Select Data ()

List 5. Execute Command ()

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Then, the name of the database, named in this project as (UOM), was entered (for more information, see the SQL connection function procedure in List 1).
Next, the database can be accessed using one of these two ways:
 Windows Authentication, then clicking on the (save setting) button, and then clicking on the (exit) button, as shown in Figure 3.
 SQL Server Authentication, in this case you must enter the user's name and login code for the database, which are prepared by the person who installs the Microsoft SQL Server program. After that, click on the (save setting) button, and then click on the button (exit), as shown in Figure 4.

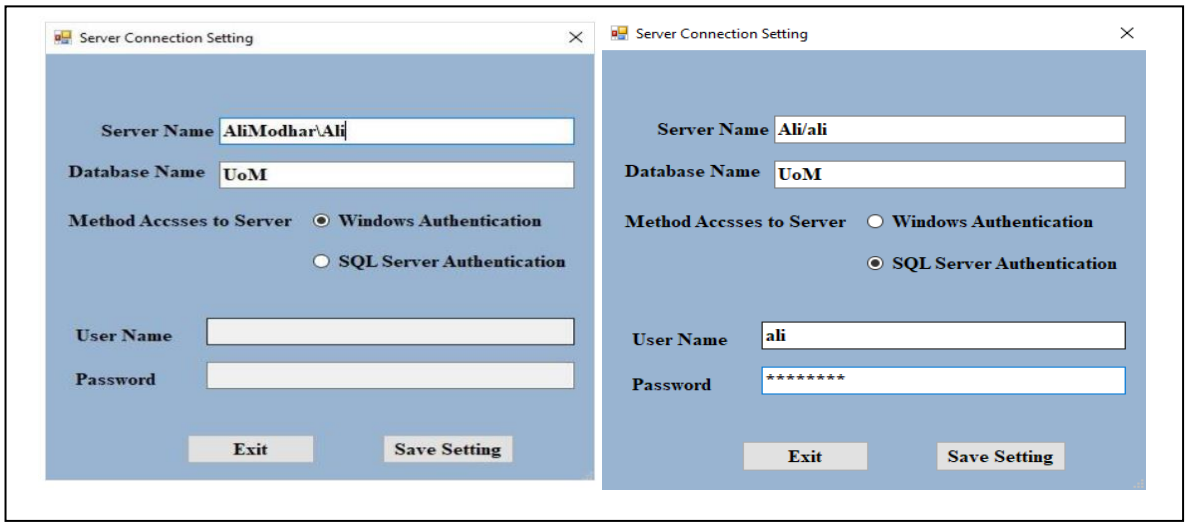

Figure 3. Server connection setting using Windows Authentication
Figure 4. Server connection setting using SQL Server Authentication

5.2 System's Interfaces and Functions

The system consisted of the following functions that are presented with a brief explanation:

1. **Main Form**

When starting to run the program, the main form interface appears. The main interface contains buttons and a background image to describe the program subject. These buttons include: Login, Student Management, Add Study Subject, Server Connection Setting, Lecturer Management, Add Department, Add College, Backup, Restore, and Exit, as shown in Figure 5.

2. **Login Button**

Login button is designed in order to obtain confidentiality for the program so that no one can enter and use the program and tamper with the data inside it except for the authorized persons who have a user name and password to enter the program.

3. **Add College Button**

This button is used for adding the information and name of the college to which the lecturer and student belong.

4. **Add Subject Button**

This button is designed to enter subject information that are used by the reporting interface.

5. **Teacher Management Button**

This button is one of the important buttons in the project, through which a special interface is opened to enter the lecturers' information in order to prepare reports on the electronic activities of the lecturers in the computer department.

6. **Student Management Button**

The function of this button is to deal with students, and it is one of the important buttons of the project, through which students can enter data and deal with this data in order to obtain their reports.

7. **Activity Management Button**

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This button is used for managing the electronic activities of lecturers in Computer Department at Mosul University. When clicking on it, an interface appears, enabling the users to enter electronic activities and print reports on activities.

Figure 5. Main form of the project

6. SYSTEM EVALUATION

To evaluate the proposed platform, a questionnaire was designed to satisfy information output from the system. This questionnaire consisted of (10) questions, the high degree depicted good satisfaction. Experiments explained that the suggested platform is more appropriate for lecturers' information management, as more than 80% of the sample studied were satisfied with the proposed project.

7. CONCLUSIONS AND FUTURE WORKS

The electronic system reduces errors caused in the manual use of lecturer's information, as well as speeding up access to data in case of viewing, changing or deleting the data. For the user, the process of dealing with graphic interface is very easy and smooth, especially Microsoft visual studio C# language provides easy work environment where it is possible to design projects of different types. The user's benefit from the lecturers' electronic activities is very great, since the lessons report is kept for the lecturers. This enables the user to open the report file and use it to manage the activity. There are two ways to save the database:

1. Inside Microsoft Visual Studio platform, it is used in case of having a few data available. This method is used when designing a low-capabilities application that does not need a lot of tables and relationships between these tables.
2. External via Microsoft SQL Server, it is used in case of having a large database application. This method is used when designing a high-capabilities application that has a lot of data, such as the project designed in this study.

It is possible to add future works to the project that will increase its effectiveness and provide more services, such as connecting the server to a network. When the Internet becomes available, it is possible to access the server and use the system. This system can be utilized in the annual evaluation of lecturers, as the evaluation process takes long time when using the paper system. It is recommended using this system in the process of identifying the lecturers who will be included in the courses, discussions, promotions, or retirement.

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