Ministry of Higher Education
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Tikrit University
College of Computer Science and
Mathematics
Department of Computer Science

Design and Implementation of a data management Model for Graduate Students /A model for College of Computer Science and Mathematics

Submitted to the Department of Computer Science / Collage of Computer Science and Mathematics / Tikrit University in a Partial Fulfillment of the Requirements for the Degree of Master in Computer Science.

by

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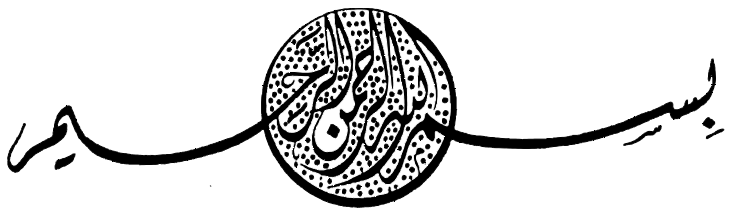

﴿ وَأَمَّا مَنْ آمَنَ وَعَمِلَ صَالِحاً فَلَهُ جَزَاءَ الْحُسْنَى وَسَنَقُولُ لَهُ مِنْ أَمْرِنَا يُسْرا ﴾

سورة الكهف

الآية : ٨٨

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With special gratitude

Ali Atalah

Abstract

With the development of modern technology ,the expansion and spread of modern networking , communications methods ,technologies, the fields , applications of human resources management and the organization of various data have multiplied to facilitate statistical operations and organizational and financial management in the state's various educational and service institutions. Design and Implementation of a data management Model for Graduate Students has become a necessary and important requirement in universities and educational institutions , because of the important services they provide in organizing and managing this data, saving time and human effort for these institutions, and contributing to organizing work in an efficient and easy manner. Since the using of a paper-based system to manage this information has become hard mission because the information might be redundant, inaccurate, ineffective, inconsistent, difficult to access and insecure. Therefore, for effective and error-free management of this information , a mechanism and techniques will be proposed in the current, which are intended to demonstrate how graduate students register for the subjects assigned to them and choose the professor (the subject teacher) and the subject that the student wants to study in this course, as well as choosing the appropriate lecture time, and the study begins at Tikrit University. It will be proposed to use JavaScript and SQL Server to implement the requirements of this study.

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List of Abbreviations

No.	Name	Description
1.	SQL	Structured query language
2.	SIS	Student information system
3.	SIMS	Student information management system
4.	SMS	Student management system
5.	SRS	Student Records System
6.	RFP	Request For Proposal
7.	HTML	Hypertext markup language
8.	UML	Unified modeling language
9.	OMR	Optical mark read
10.	WMS	Web map service
11.	WFS	Web feature service
12.	GIS	Graphic information system
13.	ESRI	Environment science research institute
14.	IT	Information technology
15.	PHP	Hypertext preprocessor
16.	DBMS	Data base management system
17.	RDBMS	Relational Data base management system
18.	SDS	Student Data system
19.	SDW	Student data warehouse
20.	RMS	Record management system
21.	PC	Personal computer
22.	CNN	Convolutional neural network
23.	IEP	Individualized Educational Program
24.	ICT	Information and Commination Technology
25.	UAT	User Acceptance Testing
26.	MVC	Model View Controller
27.	DOM	Document Object Model
28.	WCAG	Web Content Accessibility Guidelines

CHAPTER ONE

BACKGROUND

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BACKGROUND

1.1 Introduction

With the continuous advancement of modern technology and the increase in the number of schools, colleges, and universities around the world, student information has multiplied more and more. Colleges and universities are faced with a large amount of information, and it is becoming difficult to manage this information manually [1]. Using a paper-based system to manage this information has become difficult because the information may be redundant, inaccurate, ineffective, inconsistent, difficult to access, and insecure. [1],[2] Therefore, for effective and error-free management of this information, a student information management system has been developed. The concept of the database model was adopted to enhance the efficiency of keeping student information records in universities in an organized manner [3].

However, the information stored in the database will be vulnerable to a number of hacks which include; Reducing data duplication and update errors (inaccuracies), increase data consistency and integrity, facilitate easy access to information, and improve data security. The data management system is beneficial for the collection and for both students, lecturers and college authorities. Student Information System (SIS) can also be divided into Student Information Management System (SIMS), Student Management System (SMS) or Student Records System (SRS) and are all created to help maintain records digitally [4].

The primary aim behind implementing a student information system is to streamline the management of various school activities. This system

facilitates the tracking of all school-related processes, including student and faculty details, course schedules, fee structures, registration, grading, and assessment scores. Additionally, it enables the creation of student plans and facilitates tracking of attendance [5]. Development of a system further enhances data accessibility and management by allowing users to register and access or modify data based on their permissions. This system collects comprehensive data online, making it easily accessible to faculty, students, and administrators. Essentially, a student information system centralizes data points for various areas within a school, simplifying progress tracking and performance evaluation [1,7]. It provides a self-service solution for students to complete administrative tasks efficiently and supports management and staff by streamlining and integrating business processes. Standardizing data formats across departments ensures uniformity and clarity, ultimately saving time. With regard to student records, the system ensures high efficiency as all data is automatically structured and stored for easy access when needed. Its cloud-based nature allows for flexibility and scalability to accommodate organizational growth [6]. Most systems also offer open interfaces and integration with other campus applications and database systems, enhancing usability. Figure 1.1 illustrates a model of a data and student information management system for an educational institution [7].

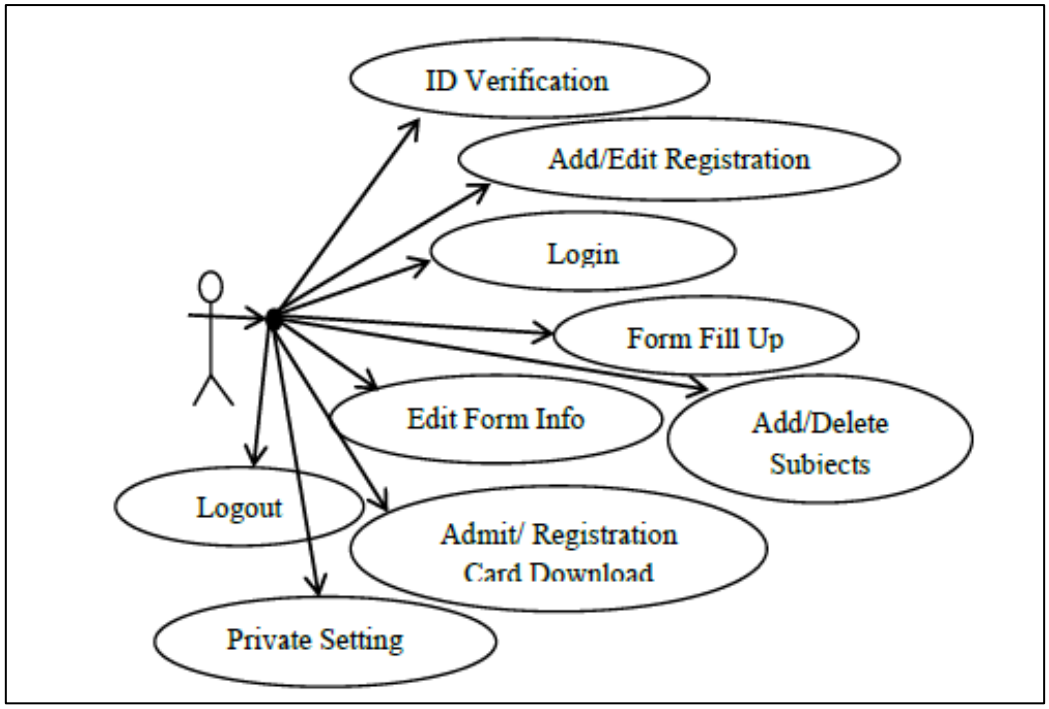

Figure 1.1An illustrative diagram of a data and student information management system model for an educational institution as an illustrative example [1,4].

1.2 Background of the Study

Student information and registration management programs are considered one of the most important organizational programs for educational institutions, as they provide an important service environment for the management of the institution [8].

It provides many services and facilities for teachers, employees, and students to browse and to enter and receive information related to study and students. These programs and systems have developed and expanded to a great extent, as they are used to document books and maintain records related to information related to students who have been registered in addition to working employees [9].

Standard educational institutions use a manual system to capture office and student records obtained from various registration portal [10]. The records used by the department are kept in the institution's stores

through documents for the rest of each semester or year to evaluate student performance. Because it takes a long time to process an RFP for a specific department if each office requests student records simultaneously. Since requests from other employees are also processed through the administrative center, this manual framework is time-consuming and mathematical errors are possible [11]. In addition, due to this thesis guide framework, there is not much security in the records. Anyone can access a registration record regardless of whether they have not been approved to do so. Pointing to a specific registration record in a specific year might suggest manually opening all the old documents until the record is found. Not only is this time consuming, but in addition to wasting assets and manual labor in transporting and moving records [12].

Standard educational institutions use a file-based system to keep records such as admission book, school fees (ledger), invigilator's book, as well as books and files for both teaching staff and students which have become expensive and vulnerable to damage and theft. These records include student admissions, student and staff discipline cases, and student performance, among other things [13]. However, this is not effective enough because books wear out, and searching for specific information in many files takes a long time with the possibility of loss before students, in addition to the possibility of damage to paper documentation records. Therefore, the need for a reliable electronic registration and documentation system has become one of the requirements of modern educational institutions, which organizes all registration[14]. documentation and storage processes with the capabilities of quickly searching for any information or file while ensuring that time and effort are reduced [15].

There are extremely strong student management systems created by various kinds of companies on the planet. There are systems with strong capabilities and uncommon systems on the Internet. Foundation proprietors or capable people could purchase the software straightforwardly from the Internet. The principal student management framework is OpenSIS, and this framework is as of now accessible in various schools in the US of America [16]. This framework has gotten more availability than required, and this framework is intended for the school system in the US of America [17]. This framework has a 15-day free time for testing to test and choose whether to purchase. The OpenSIS arrangement dashboard format is accessible in Figure 1.2.

Figure 1.2 The OpenSIS arrangement dashboard format is accessible [15].

1.3 Problem Statement

The proposed new system framework based on the web programming language takes into account addressing the problems of the paper-based administration and registration system in educational institutions. This section will discuss the problems of implementing the electronic registration system, the problems of filling out the form, and verifying the management system. To reduce errors in student registration and prepare the classroom/department and administration to manage student information and fill out the exam form related to all operations. In addition, problems with the student's form-filling record will be clarified to save it for a long time in the database, making it easier for the administrator to access the database, as well as, it could quickly generate any query result for a student in a short time [9, 20]. Student information records can be securely stored in the database, free from any manual system damage. On the other hand, the problems of the proposed system will be identified, which will provide a user-friendly and more dynamic interface, which will help guide every user to use it properly [18]. Furthermore, considering the bottlenecks in order for our system to be able to handle a large number of records in a short time. Additionally, it enables the administrator to grant the specific user permission to access the database log to analyze it for further use. To understand what the common problems in learning management systems are with the following constraints:

1) The user interface. A complicated user interface might make it more challenging for student management software to be acknowledged among school staff [14].

2) Absence of good internet offices. The fact that needs to be addressed makes extraordinary internet association one more significant issue.

3) Common problems with learning management systems include poor usability, inadequate user support, lack of scalability, and lack of access to high-quality content. In addition, many learning management systems suffer from security and data privacy issues[19].

1.4 Study Objectives and Aims

In this study, can summarize the most important requirements, desired goals, and objectives in the following points:

1. Build a non-relational database management system using cloud computer networking systems that will store student information in a document-oriented structure [21].

2. Design the user interface for the proposed system using front-end technologies such as HTML (for creating web pages), Java (for designing web pages), JAVASCRIPT (for interactive web pages), and (for responsive web pages).

3. Write some business logic for the application using the appropriate programming language.

4. To build a cloud SQL server running on localhost to create the system design using UML (Unified Modeling Language).

1.5 Significance of the Study

The proposed new system framework based on the web programming language takes into account addressing the problems of the paper-based administration and registration system in educational institutions. This section will discuss the problems of implementing the electronic registration system, the problems of filling out the form, and verifying the management system. To reduce errors in student registration and prepare the classroom/department and administration to manage

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1.6 Scope of the Study

The scope of the study clears up the degree for which this exploration region will be investigated, and the parameters inside which the review will work. It provides the reader and author a thought of what the study intends to do and what's in store. In this part, the proposal for the implementation aspect of this study will be clarified in general, as the information and user data management system describe what users will be able to do with the system. System services, constraints and objectives are created through consultations with system users and are defined in detail as the functional requirements and non-functional requirements on which the proposed application model will be built [9].

1.7 Thesis Contents and Arrangement

In this study , the detailed workflow for the complementary parts ,as follows: Using numerical equations and hypothetical basics supported by illustrative figures and diagrams, the second chapter presents the basic standards, principles and theories of computer operation, methods of data transmission, management and processing, along with an explanation of the modern methods and techniques used to design information management systems [25]. The proposed idea model for an information management and recording system is presented in chapter three , complete with representations and nuances of the recommended model recreated with design details and implementation flow charts and tables. The fourth chapter presents the implementation results, explaining and discussing them in detail [26]. in conclusion, Chapter Five will address the conclusion and future suggestions.

CHAPTER TWO

HYPOTHETICAL CONCEPTS & REVIEW

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2.1 Overview

This chapter will discuss the latest scientific articles, research and published studies that deal with investigation and research into the content of the project topic and related to the study of data management techniques and systems and student registration [27]. This chapter also includes studying the theoretical aspect and determining the idea of the topic through a hypothetical opinion using mathematical equations, illustrative graphs, and available scientific hypotheses. Also, in this chapter, the principles of computer operation and data management and processing processes are studied, with explanations based on mathematical hypotheses and available illustrations. The latest technologies and systems used in data management and processing programs will also be identified, especially those used with the subject of data classification to cover the subject from a theoretical and scientific perspective [28].

2.2 Literature Review

Many exploration articles are accessible in the writing on web-based registration management systems by utilizing different programming dialects. A couple of related works are portrayed momentarily in this study. In [29] , student registration software is created that deals with the student's enrollment and empowers the colleges to manage a developing number of services and decrease the work and costs associated with manual systems. In [30] , authors researched the manual student's registration strategies utilizing optical mark read (OMR) forms in the registration process. In these proposed systems, the issues are unfortunate

treatment of registration forms, for example, capacity challenges, administrative mistakes, re-coding, altering, and once again checking.

The scientist inspected, analyzed, and planned down to earth advances important to execute such systems to expand the proficiency of the universities' and divisions' records management [31]. The executed systems could lessen the work hours expected to get to student records and empower the staff to offer better assistance to students, [32].

In a review led in [33], there was a deficiency of centralized database systems with respect to solid, versatile, and open information. A single database framework was proposed in this study in view of a client-server distributed database for processing student records and tests [34].

In [35] , authors proposed "building a high-availability distributed application for a university student registration". Their framework ensures the consistency of nuclear exchanges with a positive result in regards to the finished registration process.

Plus, the authors in [14]. Take care of the issue connected with the management of the test exercises with decreased blunders bringing about the related degrees.

A far-off registration framework is proposed in [18] in light of the distributed database to tackle issues that both the staff and the students face during the registration time frame and accelerate and further develop framework performance and throughput. In rundown, innovation assumes a fundamental part in creating and developing various educational institutes autonomously to oversee student data in their own specific manners. Supposedly, no insightful exploration was led in regards to the plan and execution of a coordinated shrewd framework for overseeing student registration, test form tops off, electronic notification board, alumni, electronic photo gallery, checking students form by authority,

download concede card, registration card, and security framework to store information [36]. From the higher training point of view, this present circumstance is excruciating and problematic for students as well as authority. Therefore, an original coordinated framework is proposed and carried out in this exploration to deal with the issues for educational institutes like colleges [5,15].

The ongoing web mapping services guidelines incorporate the Web Map Service (WMS) and the Web Component Service Execution Determinations (WFS) [9] Since OGC's WMS was formalized before Cleanser arose, WMS and WFS don't allude to Cleanser. The locale plans, plans, builds, works and keeps up with governmentally sponsored route, flood control, typhoon security and water assets advancement projects in south central and beach front Louisiana. At USACE - New Orleans, designers and examiners have been utilizing a heap of different business software bundles to deal with their GIS and computer aided design projects, including items from companies like Intergraph, ESRI, and Bentley. A group of IT workers has been working on combination of all the software programs through a centralized method for data access. The efforts of data solidification in the beginning phases were reported in[37].

Additionally, numerous methodologies have been proposed to way to deal with web plan. Albeit the writing covers a more than adequate assortment of systems, this survey will zero in on three major methodologies that arise over and again all through the writing [38]. These methodologies are: responsive web plan, versatile web plan, and separate website. Albeit the writing addresses these methodologies in various contexts, this paper will basically zero in on their application to portable websites. Most early ways to deal with web configuration were

worried about building usable interfaces that ensure coherence between platforms with altogether different abilities.

[39] contend that the plan should zero in on one essential interface intended for the less obliged platform and apply progressive transformations to this interface to deliver interfaces for more compelled platforms.[40] suggested that a solitary gadget free show model dispenses with the need of creating and keeping up with independent gadget explicit renditions of a similar website.

Additionally, [21] advance a re-authoring approach, which comprises on lessening the show to provide an insignificant encounter to handheld gadgets. Current reasoning doesn't limit early methodologies, yet expands on them to give users access paying little mind to technological limitations. Following the blast of cell phones with program support, the production of websites explicitly streamlined for portable turned into a standard procedure.

[41] Contends that a different methodology is helpful for portable destinations on the grounds that its capacity of customization.[42] tested this thought by guaranteeing that as opposed to planning for an objective platform. The methodology ought to construct a website in progressive stages by adding more extravagant substance to the essential variant of a webpage. Latest procedures to approach multi-gadget configuration center around accomplishing a solitary web experience which easily adjusts to various gadget capacities, screen sizes, screen goals, and programs.

Marcotte [31] contended that instead of building separate gadget explicit encounters, creators could exploit standard-base innovations to composed the plan versatile to the media that render it. This is supported by Gardner, [44] who guarantees that adjusting format and content to

various review contexts across divergent gadgets can improve user experience.

A few efforts have been made to lighten the weight of result calculation that is generally borne by assessment officials (for this situation educators) in the Nigeria clime.[45] saw that when results are processed manually, it might prompt the issue of computational error, insecurity of results, chaotic results after changes probably been affected and overabundance work load on the assessment officials, etc. For these reasons a powerful, proficient and error free results processing system is expected for legitimate outcome processing [46].

Furthermore, planning also, executing a coordinated software for result processing could limit these issues. Password was utilized to concede admittance to just authorized user(s). Corrections or changes are affected without making the work messy. Additionally weight on assessment officials and computer operators will be enormously decreased [47].

In [7] the authors analyzed the deficiencies engaged with the manual strategy for computing Students' results and proposed an answer by fostering a software application to work with the robotized processing of the results. The software was created utilizing Hypertext preprocessor (PHP) scripting language and utilizing MySQL Relational Database Management System in planning the database. The created software was tried and worked true to form. With the utilization of computers for information processing, coming up next are conceivable: moment admittance to students' private and subjects information, moment student information refreshing, programmed calculation of students' results, storing student and subject information, for example, student's biodata, subject personality, subject name, and scores for result calculation, and

creating user-friendly data passage evaluates for convenience,[7] Ultimately, the deficiencies engaged with the manual technique for arranging students' outcome in auxiliary schools in Nigeria. The issues with the manual outcome processing were distinguished what's more, another system was recommended, planned, and carried out. In this work, a computer software application was created to mechanize the processing of the results. The software was created utilizing PHP programming language and MySQL (My Underlying Question Language), a relational database management system in planning the database; tried and found to have created the normal results [2]. Various Programming Languages, Programming bundles and Database management systems could be utilized to foster outcome processing software for registering students' results. PHP was utilized to speak with and control the database. Adobe Dreamweaver, a Coordinated Improvement Climate, is used to make the Realistic User Interface and to compose the codes. MySQL Server, a Relational Database Management System, is utilized to make the database tables and data. This application, however tried and viewed as working true to form, has anyway not been put to broadly utilize,[50] Java is a programming language used to fabricate programs that can work on independent computers and on the internet, its essential highlights are object-oriented and a cross-platform language [8] “By cross platform, it implies that the projects can stumble into a few platforms such as Microsoft Windows, Apple Mac, and Linux. MySQL, a Relational Database Management System (RDBMS) is utilized to make database tables and data. MySQL is very quick, solid, and simple to utilize, and its network, speed, and security make it highly fit for getting to databases, [14] Moreover, there are without a doubt a few other comparative Programming Language and Database management systems in presence.

Some past work has really been done utilizing a few of such programming languages and bundles which end up being working fine around here. There is, be that as it may, consistently opportunity to get better. This new application is planned to have decreased intricacy and more noteworthy convenience, all together to improve practicality while as yet holding great speed and accuracy Information systems used to oversee student data have been alluded to in different ways: Student Information Systems (Sister), Student Management Information Systems (SMIS), Student Data Systems (SDS), Student Data Stockroom (SDW), Student Academic Information Systems (SAIS), or Student Information Management Systems [48].

Embodies the substance of a student information system. He characterizes SMIS as "an incorporated software bundle that keeps up with, supports, and gives request, examination, and correspondence apparatuses that organize student responsibility data into information to support the educational process". An outcome management system (RMS) is just a part of a total sister bundle. The United State Division of Instruction sees student data systems as enveloping "equipment and software that give a wide range of capabilities to users, for example, storing current what's more, historical data, quickly organizing and breaking down data, and creating show formats or reporting interfaces". My point is to plan and execute a Public Optional Schools RMS, this system will have the capacity of storing current and historical data, [49] organize and examine this data as expected and the software will might be coordinated with different sister bundles assuming the need emerges. Because of the manual system, the work area officials both in Tests and in Records and Measurements who are responsible for outcome processing find it challenging to alter reported results and counterbalance

a few errors like exclusion or wrong passages. Despite the fact that these corrections are made the administrative work will look disfigured [49].

In [22] normally manual processing or manual method of producing students results generally closes with correction of errors and when they are provided out to students, they look messy [50].

2.3 Database

In computing, a database is an organized collection of data or a type of data store based on the use of a database management system (DBMS), the software that interacts with end users, applications, and the database itself to capture and analyze the data. The DBMS additionally encompasses the core facilities provided to administer the database. The sum total of the database, the DBMS and the associated applications can be referred to as a database system. Often the term "database" is also used loosely to refer to any of the DBMS, the database system or an application associated with the database.

Small databases can be stored on a file system, while large databases are hosted on computer clusters or cloud storage. The design of databases spans formal techniques and practical considerations, including data modeling, efficient data representation and storage, query languages, security and privacy of sensitive data, and distributed computing issues, including supporting concurrent access and fault tolerance.Computer scientists may classify database management systems according to the database models that they support. Relational databases became dominant in the 1980s. These model data as rows and columns in a series of tables, and the vast majority use SQL for writing and querying data. In the 2000s, non-relational databases became popular, collectively referred to as NoSQL, because they use different query languages.

2.3.1 Database Management System(DBMS)

A database management system (DBMS) is a software system for creating and managing databases. A DBMS enables end users to create, protect, read, update and delete data in a database. It also manages security, data integrity and concurrency for databases.

The most prevalent type of data management platform, the DBMS essentially serves as an interface between databases and users or application programs, ensuring that data is consistently organized and remains easily accessible. A DBMS is a sophisticated piece of system software consisting of multiple integrated components that deliver a consistent, managed environment for creating, accessing and modifying data in databases. These components include the following:

- **storage engine.** This basic element of a DBMS is used to store data. The DBMS must interface with a file system at the operating system (OS) level to store data. It can use additional components to store data or interface with the actual data at the file system level.
- **Metadata catalog.** Sometimes called a *system catalog* or *database dictionary*, a metadata catalog functions as a repository for all the database objects that have been created. When databases and other objects are created, the DBMS automatically registers information about them in the metadata catalog. The DBMS uses this catalog to verify user requests for data, and users can query the catalog for information about the database structures that exist in the DBMS. The metadata catalog can include information about database objects, schemas, programs, security, performance, communication and other environmental details about the databases it manages.

- **Database access language.** The DBMS must also provide an API to access the data, typically in the form of a database access language that can be used to modify data but also create database objects and secure and authorize access to the data. SQL is an example of a database access language and encompasses several sets of commands, including data control language for authorizing data access, data definition language for defining database structures and data manipulation language for reading and modifying data.
- **Optimization engine.** A DBMS can also provide an optimization engine that's used to parse database access language requests and turn them into actionable commands for accessing and modifying data.
- **Query processor.** After a query is optimized, the DBMS must provide a way to run the query and return results.
- **Lock manager.** This crucial component of the DBMS manages concurrent access to the same data. Locks are required to ensure multiple users aren't trying to modify the same data simultaneously.
- **Log manager.** The DBMS records all changes made to data managed by the DBMS. The record of changes is known as the log, and the log manager component of the DBMS is used to ensure that log records are made efficiently and accurately. The DBMS uses the log manager during shutdown and startup to ensure data integrity, and it interfaces with database utilities to create backups and run recoveries.
- **Data utilities.** A DBMS also provides a set of utilities for managing and controlling database activities. Examples of database utilities include reorganization, RUNSTATS, backup and copy, recover, integrity check, load data, unload data and repair database.

- **Reporting and monitoring tools.** Most DBMSes are integrated with reporting and monitoring tools to offer enhanced functionality for managing and analyzing data. Reporting tools generate reports, whereas monitoring tools track various database metrics, such as resource consumption and user activity.

2.3.2 Database types

There are several types of databases, that are briefly explained below.

- Hierarchical databases
- Network databases
- Object-oriented databases
- Relational databases
- Cloud Database
- Centralized Database
- Operational Database
- NoSQL databases

2.3.2.1 Hierarchical databases

this database follows the progression of data being categorized in ranks or levels, wherein data is categorized based on a common point of linkage. As a result, two entities of data will be lower in rank and the commonality would assume a higher rank. Refer to the diagram below:

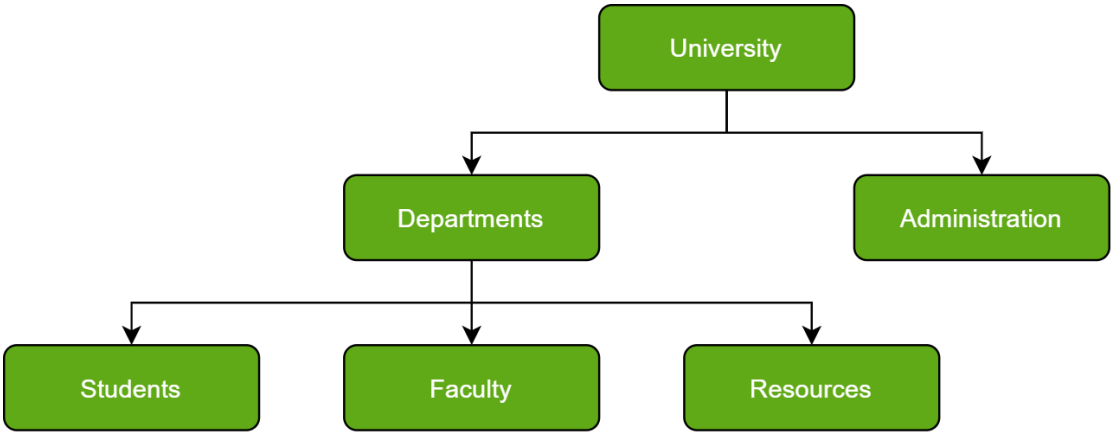


Figure 2.1 illustrates Hierarchical databases

2.3.2.2 Network databases

A network database is a hierarchical database, but with a major tweak. The child records are given the freedom to associate with multiple parent records. As a result, a network or net of database files linked with multiple threads is observed. Notice how the Student, Faculty, and Resources elements each have two-parent records, which are Departments and Clubs.

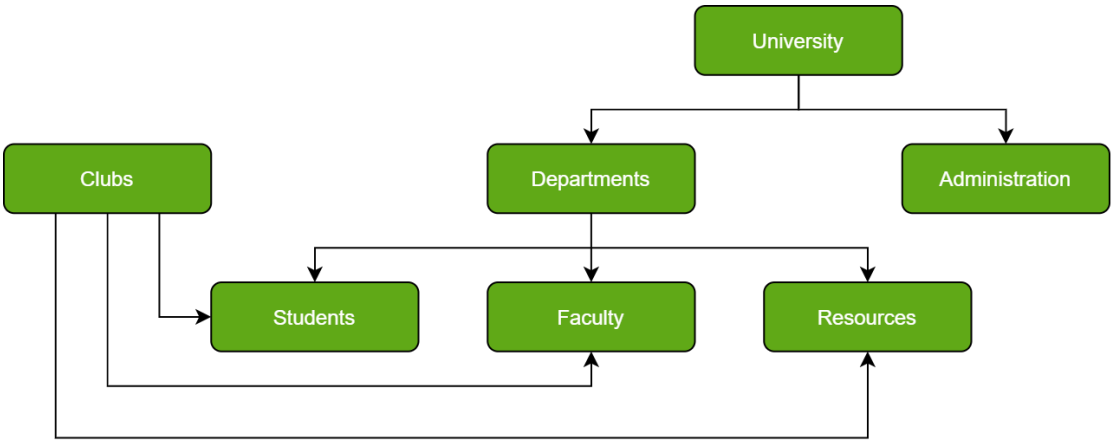


Figure 2.2 illustrates Network databases

2.3.2.3 Object-oriented databases

Those familiar with the Object-Oriented Programming Paradigm would be able to relate to this model of databases easily. Information stored in a database is capable of being represented as an object which response

as an instance of the database model. Therefore, the object can be referenced and called without any difficulty. As a result, the workload on the database is substantially reduced.

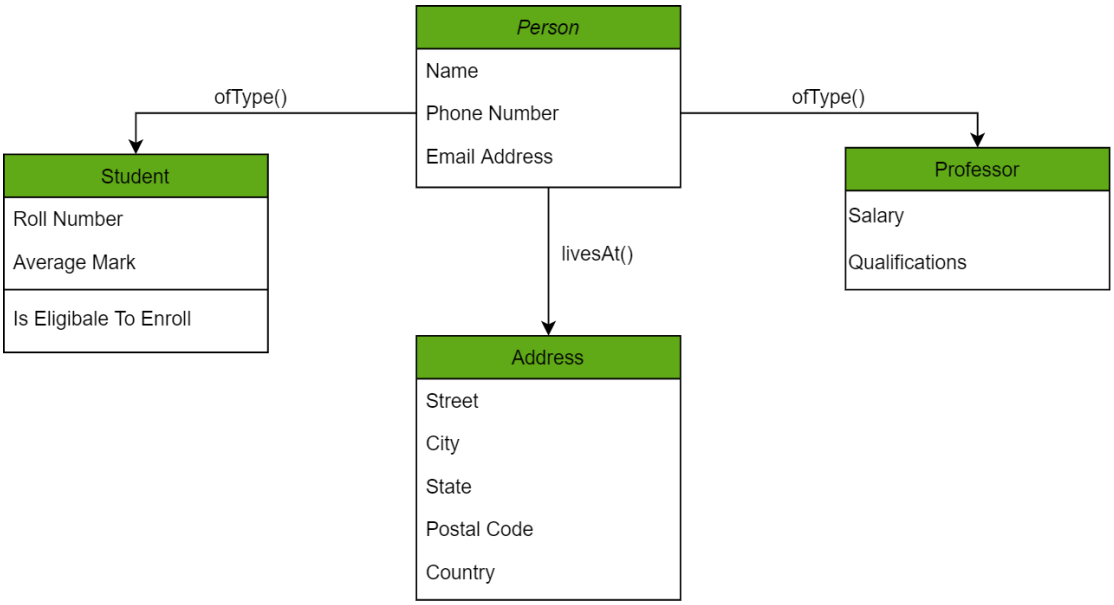


Figure 2.3 illustrates Object-oriented databases

2.3.2.4 Relational databases

Considered the most mature of all databases, these databases lead in the production line along with their management systems. In this database, every piece of information has a relationship with every other piece of information. This is on account of every data value in the database having a unique identity in the form of a record.

Note that all data is tabulated in this model. Therefore, every row of data in the database is linked with another row using a primary key. Similarly, every table is linked with another table using a foreign key.

Refer to the diagram below and notice how the concept of 'Keys' is used to link two tables.

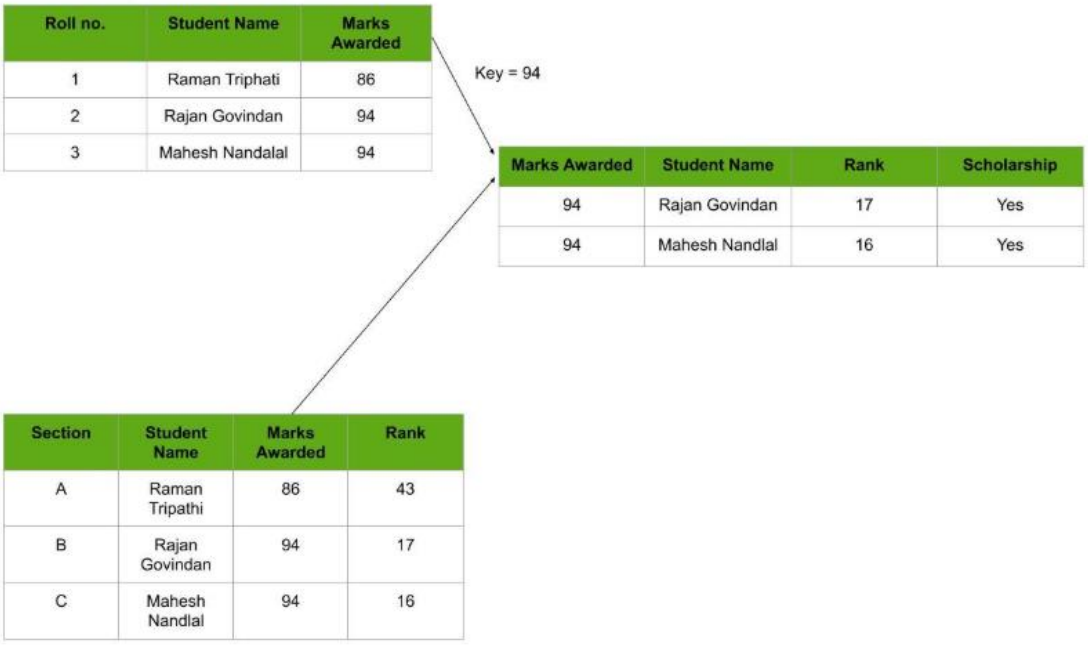


Figure 2.4 illustrates Relational databases

2.3.2.5 Cloud Database

A cloud database is used where data requires a virtual environment for storing and executing over the cloud platforms and there are so many cloud computing services for accessing the data from the databases (like SaaS, Paas, etc). There are some names of cloud platforms are-

- Amazon Web Services (AWS)
- Google Cloud Platform (GCP)
- Microsoft Azure
- ScienceSoft, etc.

2.3.2.6 Centralized Database

A centralized database is basically a type of database that is stored, located as well as maintained at a single location and it is more secure when the user wants to fetch the data from the Centralized Database. There are advantage for Centralized Database such as Data Security, Reduced Redundancy and Consistency, but there are

disadvantage for it such as the size of the centralized database is large which increases the response and retrieval time and
it is not easy to modify, delete and update.

2.3.2.7 Operational Database

It is used for creating, updating, and deleting the database in real-time and it is basically designed for executing and handling the daily data operation in organizations and businesses purposes.

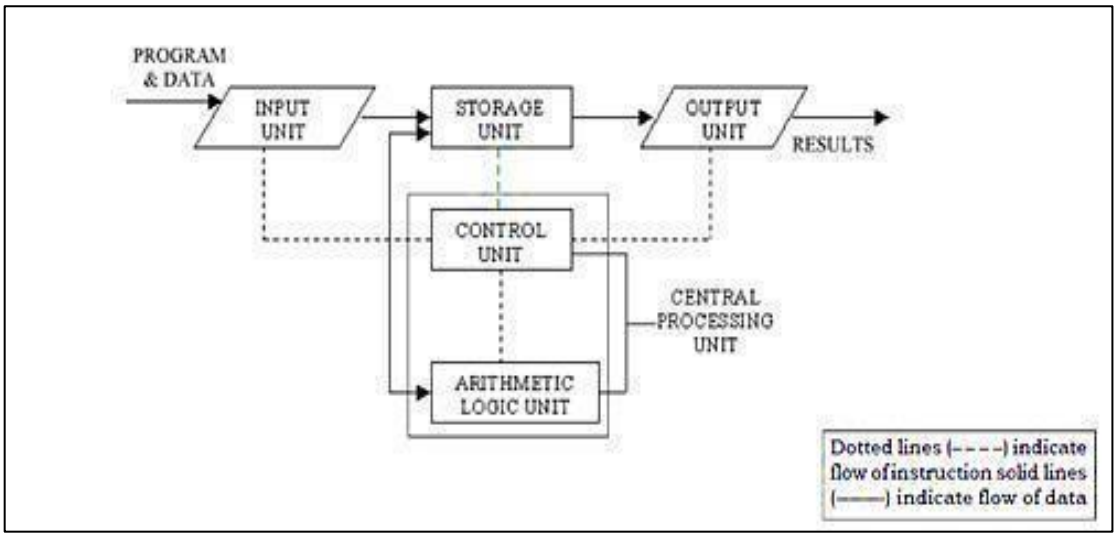
2.3.2.8 NoSQL databases

A NoSQL originally referring to non SQL or non-relational is a database that provides a mechanism for storage and retrieval of data. This data is modeled in means other than the tabular relations used in relational databases. A NoSQL database includes simplicity of design, simpler horizontal scaling to clusters of machines, and finer control over availability. The data structures used by NoSQL databases are different from those used by default in relational databases which makes some operations faster in NoSQL. The suitability of a given NoSQL database depends on the problem it should solve. Data structures used by NoSQL databases are sometimes also viewed as more flexible than relational database tables.

2.4 The Concept of Computer Systems

A computer with extra equipment and software together is known as a computer framework. A computer framework comprises basically of a central processing unit (computer chip), memory, input/yield gadgets, and storage gadgets. This large number of parts work all together unit to convey the necessary result. In fact, a computer-based information system is a technologically implemented means of recording, storing and disseminating linguistic expressions and drawing conclusions from this expression [15]. A computer is an electronic device that could be

programmed to accept data (input), process it and generate the result (output) [40]. A computer works together with data and software, where additional hardware and software together are called computer system. A computer system consists primarily of a mainframe central processing unit (CPU), memory, input and output devices as well as storage devices. All of these components operate together as one unit to deliver the required outputs. computer systems come in various schemes and sizes. It can vary from a high-end server to a personal desktop, laptop, tablet or smartphone. Figure 2.5 shows the schematic diagram of a computer system structure[15].



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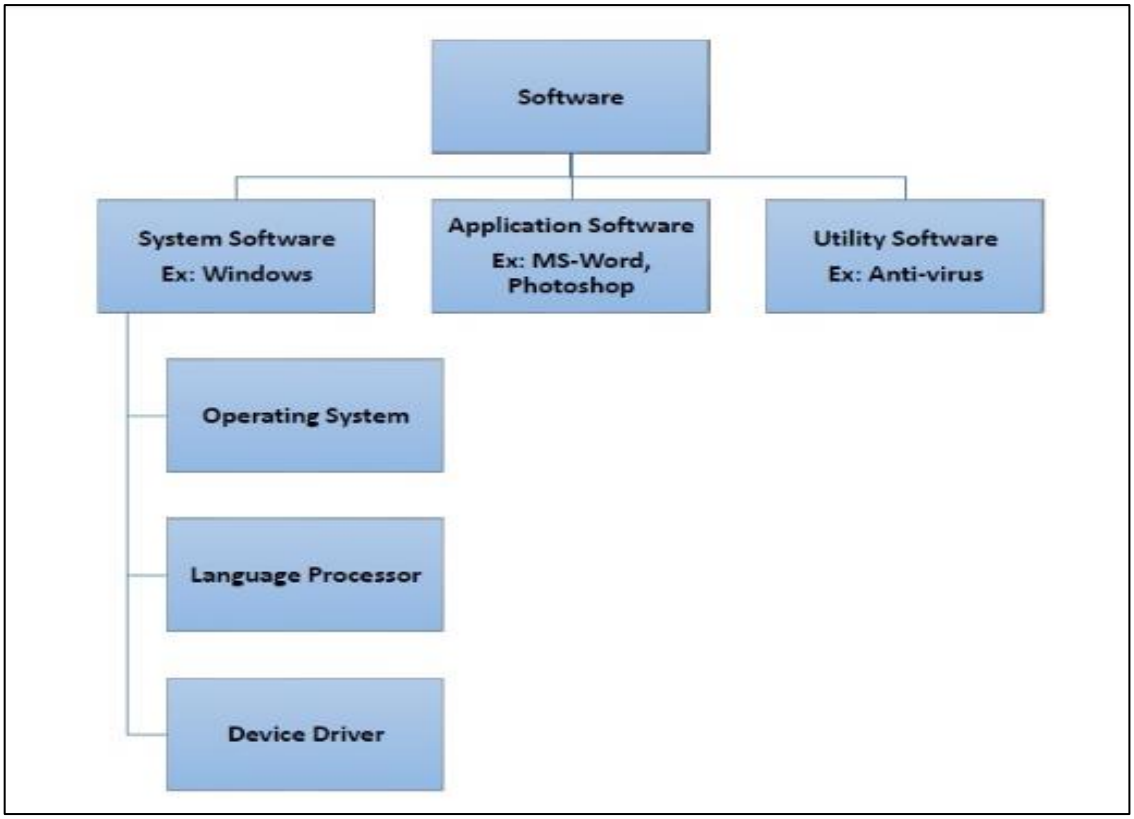


(b)

Figure 2.5The schematic diagram of a computer system structure, (a) Hardware model, (b) Software model [14,20].

As shown in Figure 2.1, the computer system basically consists of four basic units: the input unit, the central processing unit, the storage unit, and also the "output unit [14,47].

2.5 Web Services

Web services are a type of internet software that use standardized messaging protocols and are made available from an application service provider's web server for a client or other web-based programs to use. These services are sometimes referred to as web application services.

The purpose of a web service is to provide clients with a particular product or service. For example, Google offers a variety of web services that involve storing information, such as email or cloud storage drives.

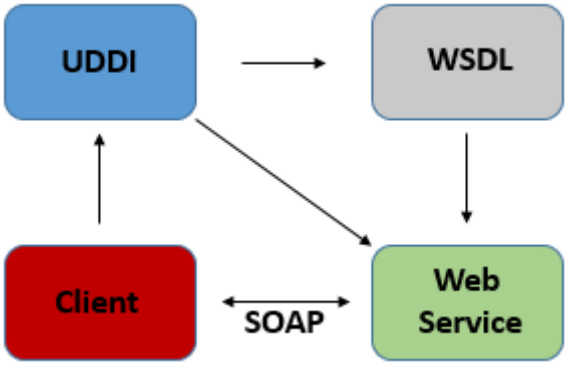


Figure 2.6 illustrates how web services operate.

2.6 Cloud services

Cloud services are application and infrastructure resources that exist on the Internet. Third-party providers contract with subscribers for these services, allowing customers to leverage powerful computing resources without having to purchase or maintain hardware and software. There are several cloud's services such as Email, Calendar, Skype, WhatsApp ,etc..

2.7 Computer System Relevance in Data Processing

Computer data processing includes changing over crude data into a machine-readable form, with the data moving through the focal processing unit and memory to yield gadgets, and formatting or transforming the result. Any utilization of computers to perform explicit procedure on data can be incorporated under data processing [51].

Among the inquiries that come to analysts' brains is: The reason do we want computers to process data and information? To respond to such an inquiry, we want computers to process data, since data are crude realities that poor person yet been processed, and therefore in the wake of processing them, they are transformed into information that is significant to the end user [52]. Consequently, computers aids data passage, altering, data management including finishing follow-up techniques, and so forth. Computers likewise permit more noteworthy adaptability in recording

data as it is gathered and more prominent straightforwardness in breaking down this data [53].

2.7.1 Computer Data Processing

Data processing is any computer process that changes over data into information. The processing is typically thought to be mechanized and run on a centralized server, minicomputer, microcomputer, or PC framework. Since data is most helpful when the introduced data is very much processed and informative, the systems are frequently alluded to as information systems to underscore their down to earth application [54]. In any case, the two terms are practically equivalent, performing comparable changes; Data Processing Systems Crude data is normally processed and transformed into information, as well as information systems normally accept crude data as contribution to deliver information as result. Information could be characterized as the portrayal of realities, ideas, or directions in a formal way, which should be reasonable for correspondence, translation, or processing by a human or electronic machine. Information is structured or grouped information, which has a significant worth to the beneficiary [55]. Information is the processed information on which choices and activities are based [56]. To more readily market their calling, a computer software engineer or a systems investigator that could whenever have alluded, for example, during the 1970s, to the computer systems that they produce as data-processing systems generally these days alludes to the computer systems that they created by some other term that incorporates the word information, like information systems, information innovation systems, or management information systems [57]. In the context of data processing, data are characterized as numbers or characters that address estimations from this present reality. A solitary datum is a solitary estimation from this present

reality. Estimated information is then algorithmically inferred or potentially legitimately derived and additionally statistically determined from numerous data. Information is characterized as either a significant solution to a question or a significant upgrade that could flow into additional inquiries Figure 2.2 shows a schematic diagram of the computer data processing structure [58].

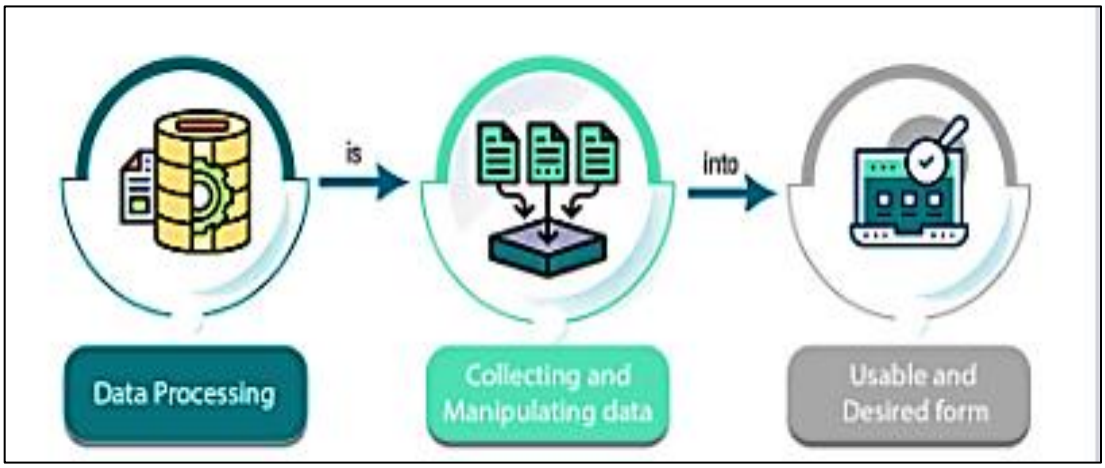


Figure2.7 Shows a schematic diagram of the computer data processing structure [20,47].

Basically all normally happening processes might be seen as instances of data processing systems where "genuine world" information as strain, light, and so on are changed over by human eyewitnesses into electrical signs in the sensory system as the faculties we perceive as contact, sound, and vision.[59] Indeed, even the cooperation of non-living systems might be seen in this manner as simple information processing systems [60] Customary utilization of the terms data processing and information systems confine their utilization to allude to the algorithmic determinations, logical allowances, and measurable estimations that repeat perpetually in everyday business conditions, as opposed to in the more the extensive feeling of all transformations of certifiable estimations

into genuine world information in, say, an organic biological framework or even a logical or engineering framework [61].

2.7.2 Data Analysis

Online business, generally named electronic exchange or web exchange, insinuates the exchanging of work and items using the web, and the trading of money and data to execute these trades. Electronic business is much of the time used to suggest the proposal of genuine things on the web, yet it could in like manner portray any kind of business trade that is worked with through the web [62].

Information or data analysis is becoming plausible at reasonable expense. Numerous web-based business associations rely upon Big Data Analysis in gathering constant; and acquiring important bits of knowledge that drive benefit and more intelligent business choices. This examination is set to inspect innovative difficulties that are related with the utilization of Big Data investigation in web based business and recommend a structure blocks as a source of perspective engineering [25], The review is expected to help online business directors to successfully understand the issues behind utilizing big data examination and how to manage it a great deal of Ecommerce merchants are embracing web-based entertainment investigation for the accompanying reasons: [63]

1) To acquire upper hand and business values.

2) Drive client traffic.

3) Assisting the client dependability and maintenance.

Further develop deals and incomes, further developing consumer loyalty; and above all to make brand mindfulness and assemble notoriety. There are basically two common techniques for analyzing social media data, which might include: Text mining, and sentiment analysis (using

CNN algorithms) as shown in Figure 2.8. Social Media Networks with virtual entertainment, or as it is called social media, is giving individuals a stage to collaborate with one another. Notoriety of virtual entertainment destinations like face book, instagram, and amazon has expanded unimaginably in most recent couple of years. The center of the informal communication experience fixates on client's capacity to perform following activity [64]:

- Online space for self-expression through of sending self-relevant data on specified profile web page.
- Connectivity/interaction against partners as well populations.
- Network extension.

Social media data might be leveraged in two kinds of analysis:

A) Content Based Analysis: Social networking sites like face book, instagram and amazon have tremendous amount of content in the form of text, image, audio and video. This huge database can be used for various researches.[65]

B) Linkage Data Based Analysis: Social network can be analyzed with mapping and measuring of relationships between various entities.

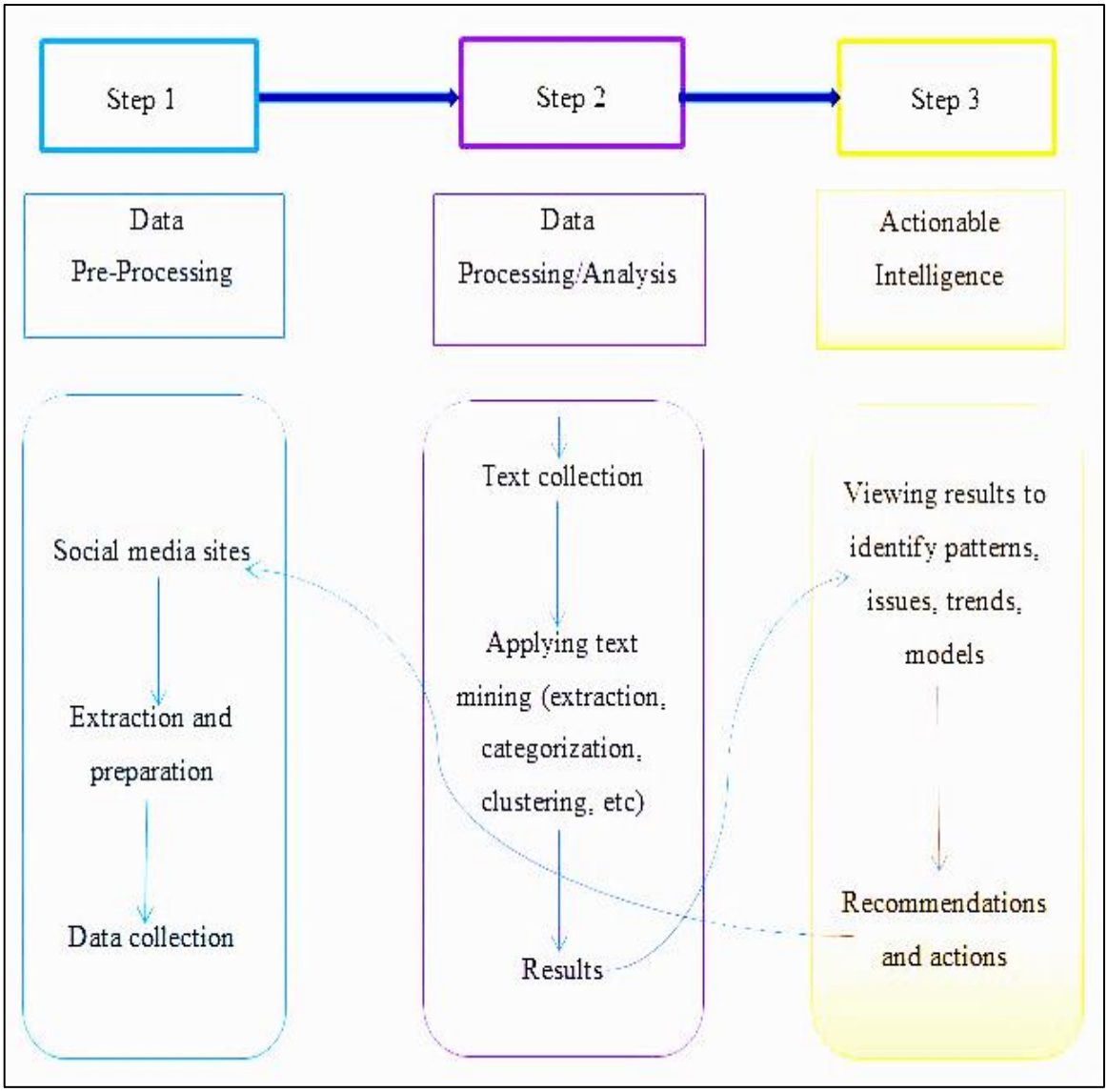


Figure 2.8Analysis of Social Media Data [14,46].

2.7.3 Data Processing

Data processing, or computer data processing includes changing over crude data into a machine-readable form, streaming the data through the central processing unit and memory to yield gadgets, and formatting or transforming the result. Any utilization of computers to perform explicit procedure on data can be incorporated under data processing. Data processing basically centers around changing over crude data into a structured format for storage, management, and investigation[66]. Data mining, then again, centers around extricating significant examples,

connections, and bits of knowledge from processed data [14-29]. This approach is exceptionally reliant upon the utilization of text, picture, sound, and recordings-based content from web journals and online entertainment destinations to make judgment on the pertinence of an issue. As presented in the Figure 2.9, data gathered is separated utilizing a catchphrase channel to recover applicable information. The data processing advertiser creates rundown of catchphrases relating to the item being checked. These catchphrases can be utilized to recognize feelings about an item [67].

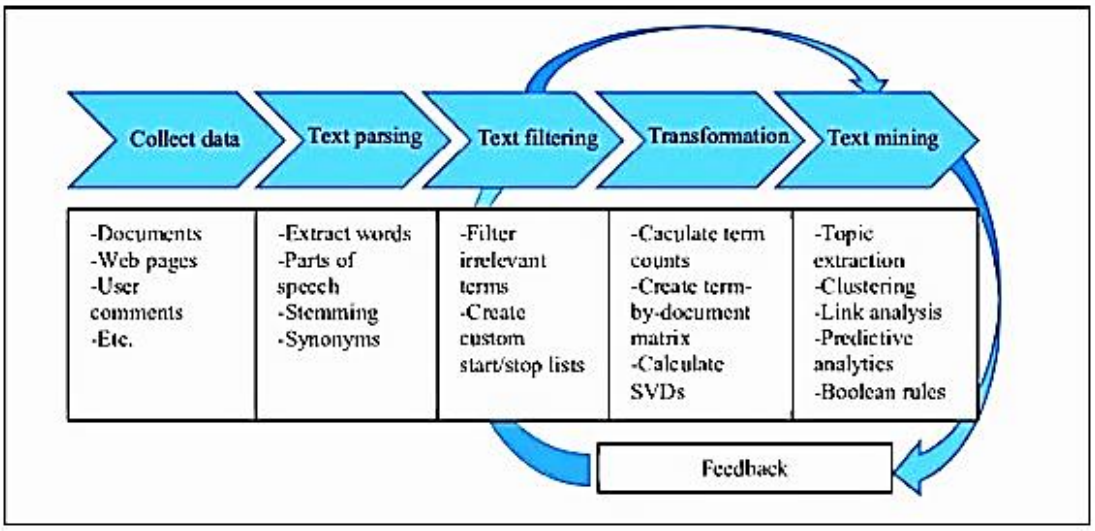


Figure 2.9 Block diagram of data processing (Text Mining example) process [8,28].

2.8 Problems Associated with Data Processing

Data processing is indispensable for service institutions seeking to enhance their business strategies and bolster competitive and organizational capabilities [68]. By converting data into readable and analyzable formats like graphs, charts, and various documents, employees and users across these institutions can effectively understand, assimilate, and manage data, thus leveraging it more efficiently [69].

However, a major challenge in data processing lies in storage. The vast quantities of data generated daily through information management and recording systems present a significant hurdle in storing this data, particularly when it's arranged in various forms and formats within older systems [70]. This becomes especially problematic for unorganized data that cannot be easily stored in traditional databases, posing a significant obstacle in data processing within computer devices [71].

Another critical issue in data processing systems is latency or time delay between data collection operations and the receipt of final results[72]. This delay can occur during permanent data collection operations, where the primary data (big data) may not be updated in a timely manner. Consequently, data processing becomes less effective as data is processed only once, leading to potential delays. Hence, addressing this time delay is crucial to optimize data processing efficiency [73].

Moreover, data processing is paramount for ensuring service privacy and enhancing business operations. By transforming data into formatted forms such as mathematical drawings, diagrams, and various documents, employees and users across national and service sectors can effectively comprehend, assimilate, and manage data resources [74].

In summary, the main challenges in processing program data revolve around storage limitations and time delays, underscoring the importance of addressing these issues to streamline data processing operations.

1) Dependence on data size.
2) Storage Memory.
3) Data duplication.
4) Limited data sharing.

5) Large development times.

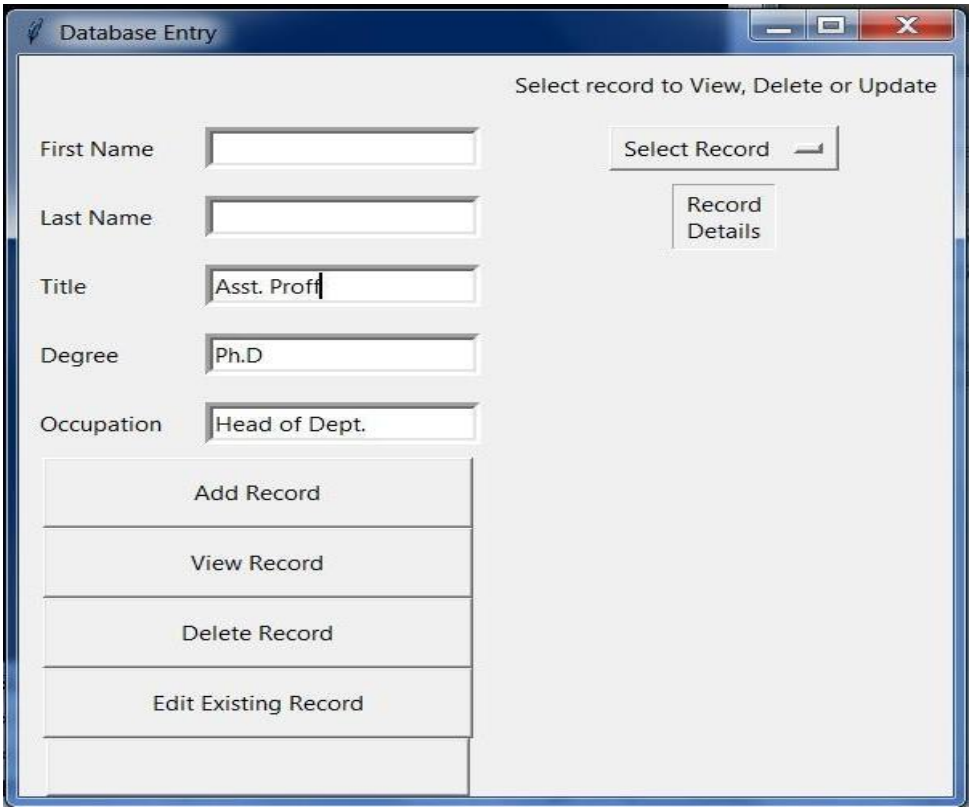
6) Excessive program maintenance.

7) Processing time delay.

2.9 Result Formats

The results format serves to succinctly present the study findings within the context of the research question(s) [75]. Study data is logically sequenced and presented without bias or interpretation. Results may be communicated through composed text, tables, graphs, and various illustrations. Utilizing the outcome format boundary helps determine the level of detail for validation results within data archives [76]. For instance, this could involve returning a success or failure message, summarizing observed qualities, listing failed values, or implementing a query or filter capability to retrieve all failed lines [77].

Data processing outcomes are typically integrated into user information management systems following analysis and processing by electronic computers. This can be achieved through various means, with the simplest being the presentation of readable data in text files. Alternatively, results can be visually presented in the form of images. However, the most effective method for displaying results within user information management systems is through graphical user interfaces [78], as depicted in Figure 2.5.



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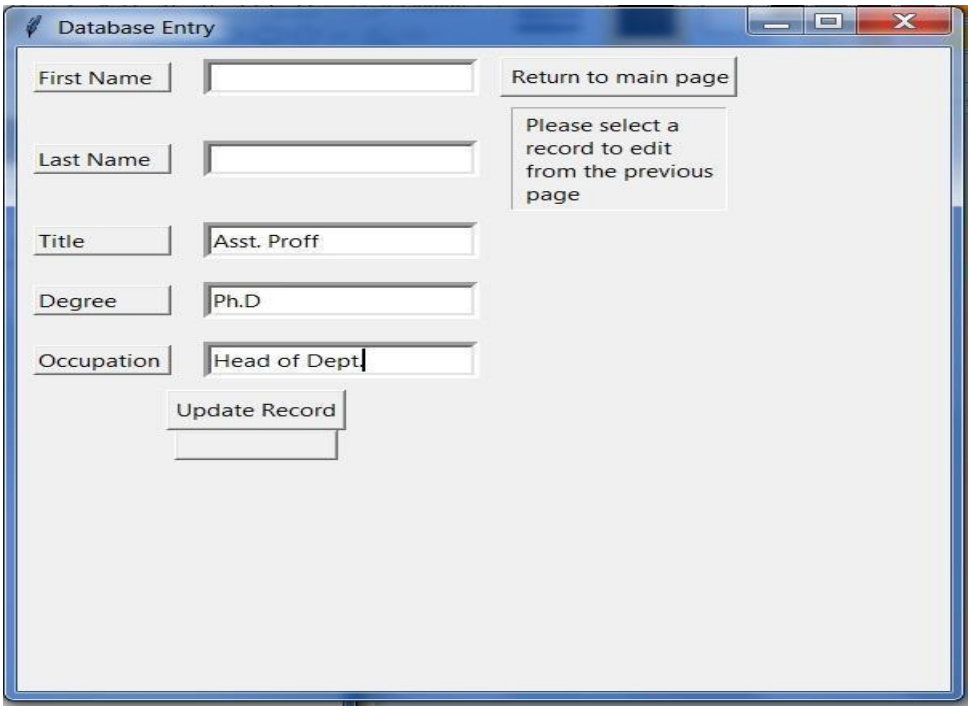


(b)

Figure2.10 Results formatting data entry using graphical user interfaces, (a) Main GUI page, (b) Secondary GUI page [14,48].

2.10 Results Processing

Working out and storing student results and information about students' academic accomplishment in every semester is a principal issue for each educational establishment; Upon effective fruition of the academic evaluation, students try to know their performance, and the best way to give this to students after the evaluation is through the last semester results or transcripts [79]. Processing of results and texts is an imperative part of all degrees of formal training since it decides the degree of academic accomplishment of students at the professional level. The apparent difficulty in the flow framework for addressing student academic results spurred me to direct this exploration [80]. The framework ended up being dreary and tedious, particularly when carried out for an enormous number of students, as well as making the whole process cumbersome and error-prone. Processing of results or scores is essential for the post-test process that needs accuracy and transparency as students' improvement relies upon their report card and scorecard [53, 81].

Result Processing Framework forms the critical exercises in the life expectancy of a student. The interest for viable and proficient outcome calculation and result presents the need to robotize existing manual outcome processing systems. The digitized process gives capacities, for example, a centralized repository for storage, management, and scattering of result information to those concerned [82]. A prerequisite get-together activity in view of the evaluation of the current manual process uncovers that it is wasteful and rigorous [83]. The manual exercises of the current framework were recognized and displayed with the UML object-oriented procedure. Delicate advancements, for example, the hypertext preprocessor - a high-level scripting programming language and MYSQL

database management systems were consolidated in the execution of the student result processing framework. The planned and carried out framework had the option to provide a vigorous database that produces different reports that are pertinent to optional schools [84].

The reports included results outline, results' broadsheet, students' outcome sheet, etc. These reports are downloadable on the grounds that the framework might produce them in PDF format [85]. The framework is novel in that it tends to be taken on and adjusted to suit the outcome processing quirks of any open optional school [14,46].

2.11 The Features of Result Processing

Its score processing features incorporate last calculations such as normal scores and the production of score report sheets and transcripts. At every session, results highlight track student status information as recorded in the student's files, determining whether the student meets enrollment requirements [86]. Processing results means the results of processing system data for processing purposes and might remember for specific aggregated system data, system data visualizations, statistics, conclusions, insights, and additionally correlations got from system data[87]. Information refers to the significant result acquired subsequent to processing the data. Data processing thus refers to the process of changing over crude data into significant outputs, for example information [88].

2.12 Modes of Results Processing

Result must be conveyed to the person who wishes to use it. It tends to be imparted in a number of ways for instance:[89]

a) By word of mouth (for example telephone) by sight (for example witnessing or observing something) even by contact, smell or taste
b) On paper

i. as a report

ii. as a set of figures

iii. as an outline or graph

iv. as a photograph or picture

c) In a form that is not humanly sensible that in a form that humans can't use without the assistance of a computer or special gear. Microfilm what's more, microfiche are examples of this and computer files of attractive disks, or attractive tapes are others [90]. The correspondence of the information would, in these cases, be communications among machines and humans would then need to use a machine such as a computer or microfilm reader to get access to the information they need. Information and organization are brought together. Information is conveyed so that decisions can be taken [91].

Today, most of the websites are built using MVC (model view controller) architecture. In MVC architecture, React is the 'V' which stands for view, whereas the architecture is provided by the Redux or Flux, and wich characterized by:

• **JavaScript XML**, known as JSX. It is a syntax extension for JavaScript. React JS uses an XML- or HTML-like syntax. React Framework calls in JavaScript are generated from this syntax.

• **Components**: The foundation of React JS are components. A React JS application consists of several components, each with its own controls and functionality. When working on larger-scale projects, the reusable nature of these components aids in code maintenance.

• **One-way Data Binding**: React JS was created with one-way data binding, or unidirectional data flow, in mind. One-way data binding's advantages provide you more control over the entire program. It needs

extra functionality if the data flow is going in a different direction. The reason for this is that parts are meant to be unchangeable and
a pattern called flux aids in maintaining the unidirectionality of your data. This increases the application's flexibility, which boosts productivity.

• **Virtual DOM**: An instance of the original DOM object is represented by a virtual DOM object. Like a one-way data binding, it functions , the complete user interface is re-rendered in virtual DOM representation whenever changes are made to the web application. Next, it compares the differences between the new DOM and the old DOM representation. When it's finished, just the things that have truly changed will be updated in the real DOM. As a result, there is no memory waste and the application runs faster.

• **Simplicity**: React JS leverages JSX files, which simplify the application's coding and comprehension. React JS is known to be a component-based method that allows you to reuse the code as needed. It is therefore easy to use and learn.

• **Performance**: React JS is renowned for its outstanding performance. It is significantly superior than other frameworks available today because of this capability. It does this because it is in charge of a virtual Document Object Model. An API for programming that works with HTML, XML, and XHTML is called the DOM. It is cross-platform. The full existence of the DOM is in memory. As a result, we didn't write straight to the DOM when we created a component. Rather, we are creating virtual components that will eventually become the DOM, resulting in quicker and more seamless performance. Figure 2.6 demonstrates react’s features

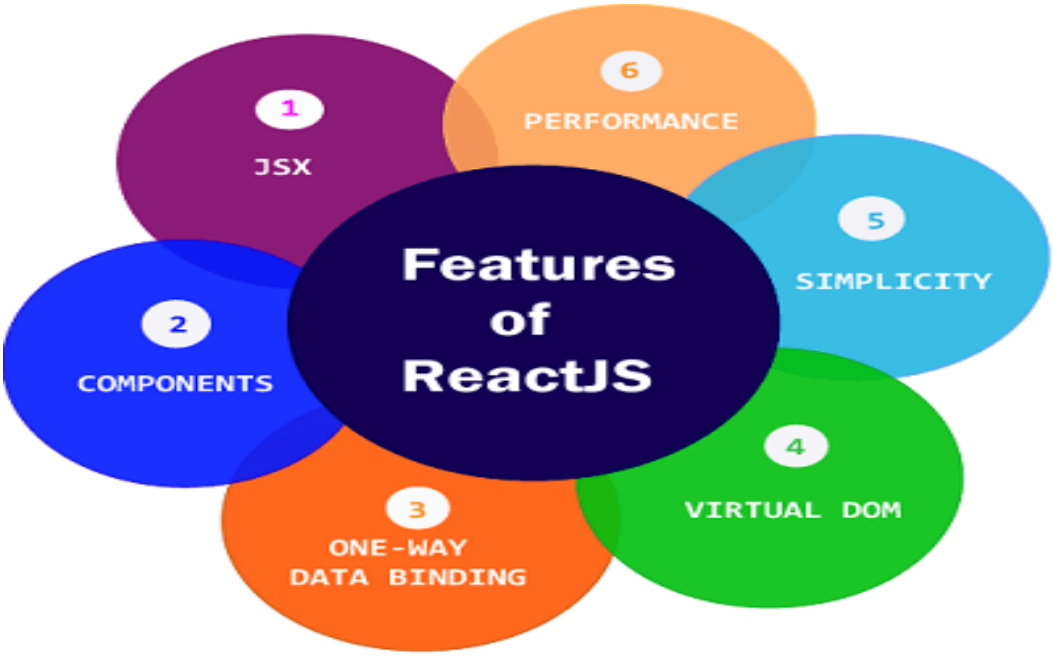


Figure 2.11 illustrate react features

2.13 The Centralized Results Processing

Centralized results are processed in a single computer or in a gathering of computers coupled in one area .The computer is accessed through "dumb terminals", which just send inputs and get outputs, or "smart terminals", which add screen formatting. All data processing takes place in the central computer.[92] Figure 2.12 displays a schematic diagram of the centralized results processing system [21,48].

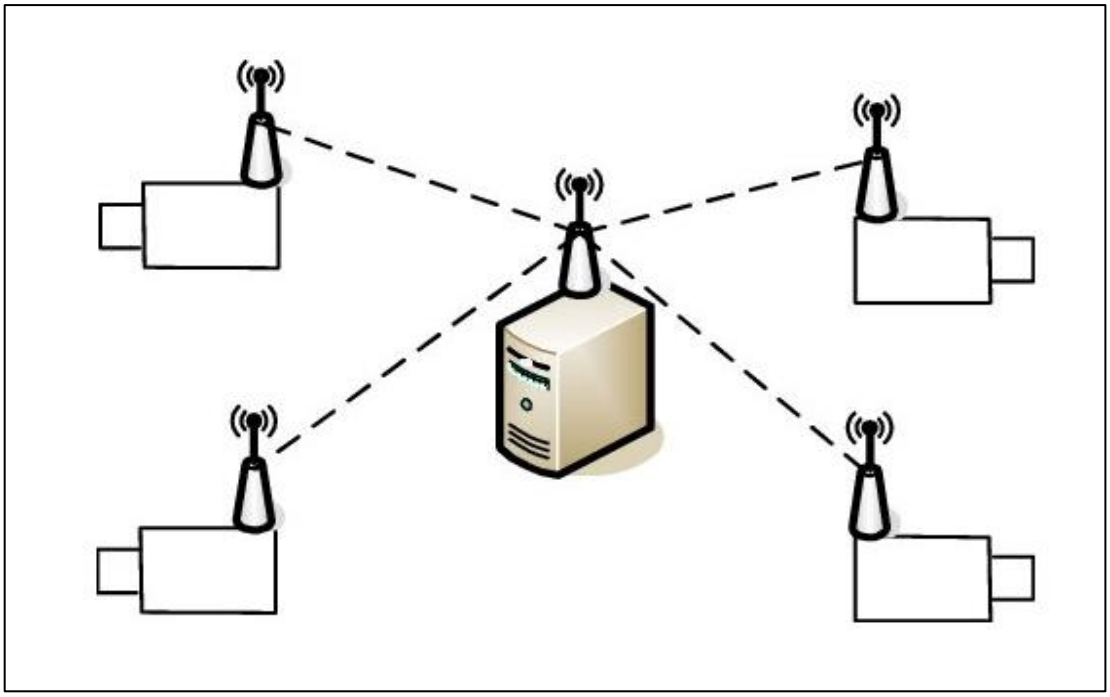


Figure 2.12 A schematic diagram of the centralized results processing system [21,48].

2.14 The Decentralized Results Processing

This decentralized results processing is that processing accomplished at numerous sites. In contrast to central processing, by observing the distributed processing [93]. Decentralized processing means that every site might perform the same kind of processing yet with various data; For instance, each part of an enormous organization processes orders for its neighborhood customers [94] . Decentralization is the process by which organized activities, especially those connected with arranging and decision-production, are distributed or designated away from a central, trusted area or gathering and given to smaller factions inside it. Figure 2.13 shows a schematic diagram of the decentralized results processing system [21,48].

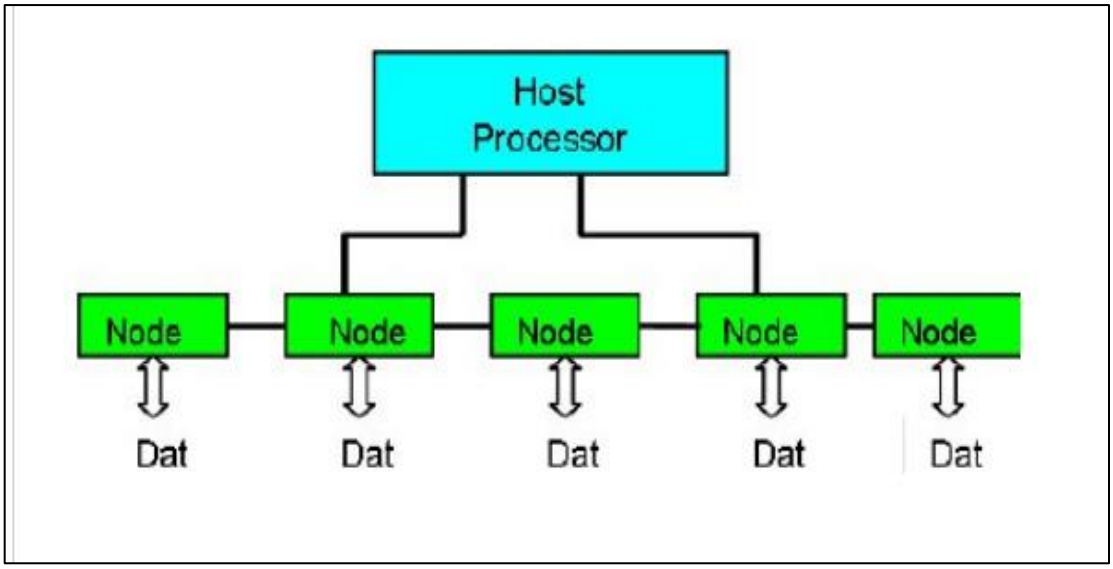


Figure 2.13 A schematic diagram of the decentralized results processing system [17,18].

Decentralized data processing is an innovation that allows data to be processed and analyzed without depending on a central authority. Instead of that, data is stored on numerous nodes inside a decentralized network [95].

2.15 Testing Methods

A test in research methodology is a way of assessing the validity of a research method. There are two main types of tests: statistical tests and experimental tests. Statistical tests are used to determine if a research method is valid by assessing the data that is collected , as for by conducting controlled experiments, you can validate hypotheses, measure the impact of changes, and make informed decisions based on statistical evidence. At its core, experiment testing involves comparing different versions of a product or feature to determine which performs better.

2.16 Evaluation Methods

Evaluation is a systematic process to measure the demonstrable effect of an intervention, for example the activities carried out as part of a project or program. Evaluation can also be a powerful tool to document and communicate the concrete impact of an organization's work. There are three main types of evaluation methods are goal-based, process-based and outcomes-based. **Goal-based** evaluations measure if objectives have been achieved (We highly recommend S.M.A.R.T. Goals). **Process-based** evaluations analyze strengths and weaknesses. **Outcomes-based** evaluations examine broader impacts and often investigate what greater good was served as a result of the program or project.

2.17 Security Methods

A 'Security Method' in Computer Science refers to the methodologies used to ensure the security of Smart Grid protocols, such as SCADA and ICS protocols. These methods are designed to create a secure and integrated system for Smart Grid operations. This method uses the RSA algorithm for cryptography and it is built to work on the standard communication stack. This security architecture requires less energy, memory overhead, and latency, hence it is very well suited for IoT memory constrained energy efficient IoT devices. To secure IoT communication authors in have proposed a secure multi-hop routing protocol (SMRP), uses security methods in its routing protocol which helps in faster cryptographic performance helps this to run on memory constraint hardware chips.

CHAPTER THREE

RESEARCH METHODOLOGY

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

The main objective for this study is to identify a suitable conceptual framework for the Student Registration in a way that can be equal to the traditional classroom and thus it can be applied to the Iraqi students in the universities. This chapter presents the details of the adopted research methodology through mix-methods in five phases. The first phase focuses on the quantitative data collection while the second phase describes on the qualitative data collection and the third phase include demonstrate and analysis, the phase four related to development the proposed framework .Finally the final phase concerns the methods of data collection and data analysis. figure 3.1 demonstrates these phases

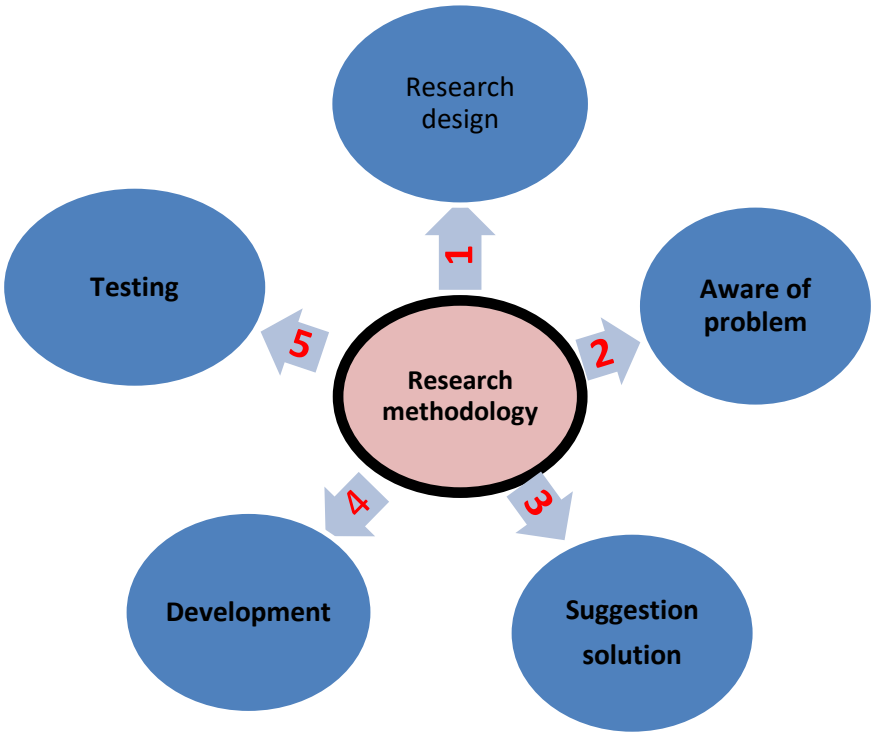
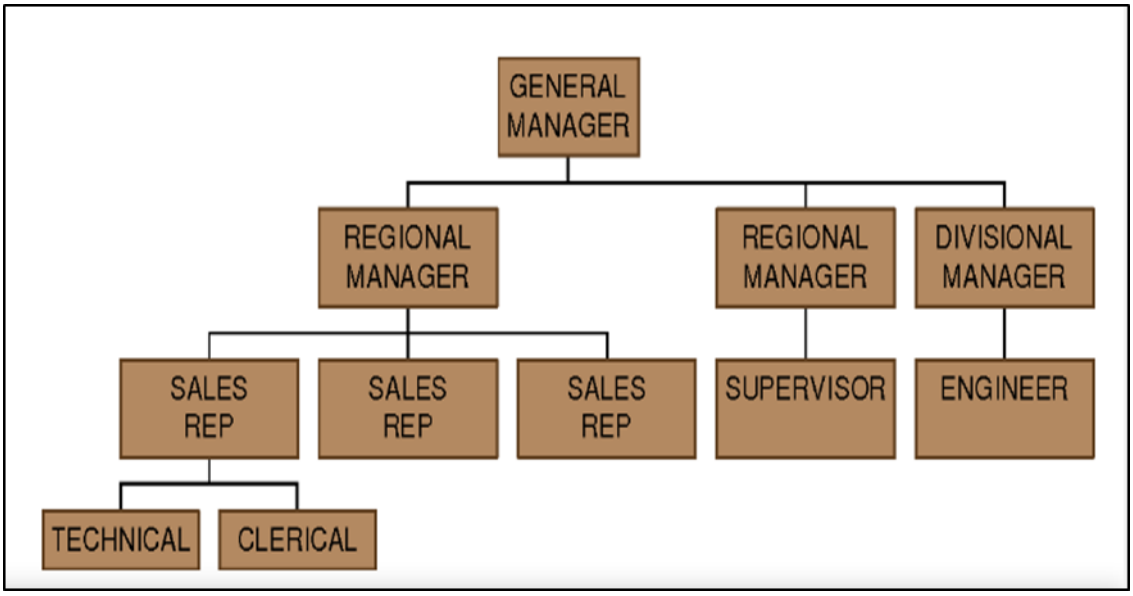


Figure 3.1 phases of research methodology

Figure 3.2 demonstrates the general levels of the suggested student manager system [24].



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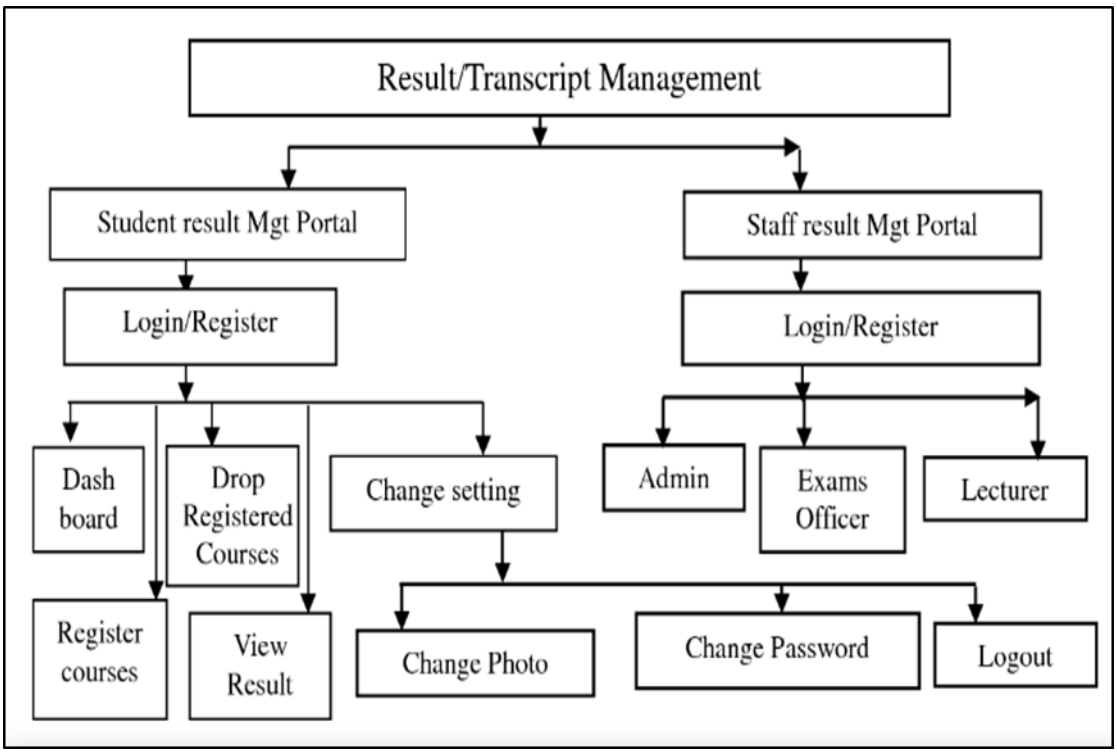

(b)

Figure 3.2 A general flow charts of the suggested student manager system, (a) Admiration flow chart, (b) Management flow chart

A use case is a methodology used in system analysis to identify, clarify and organize system requirements. The use case is made up of a set of possible sequences of interactions between systems and users in a particular environment and related to a particular goal.

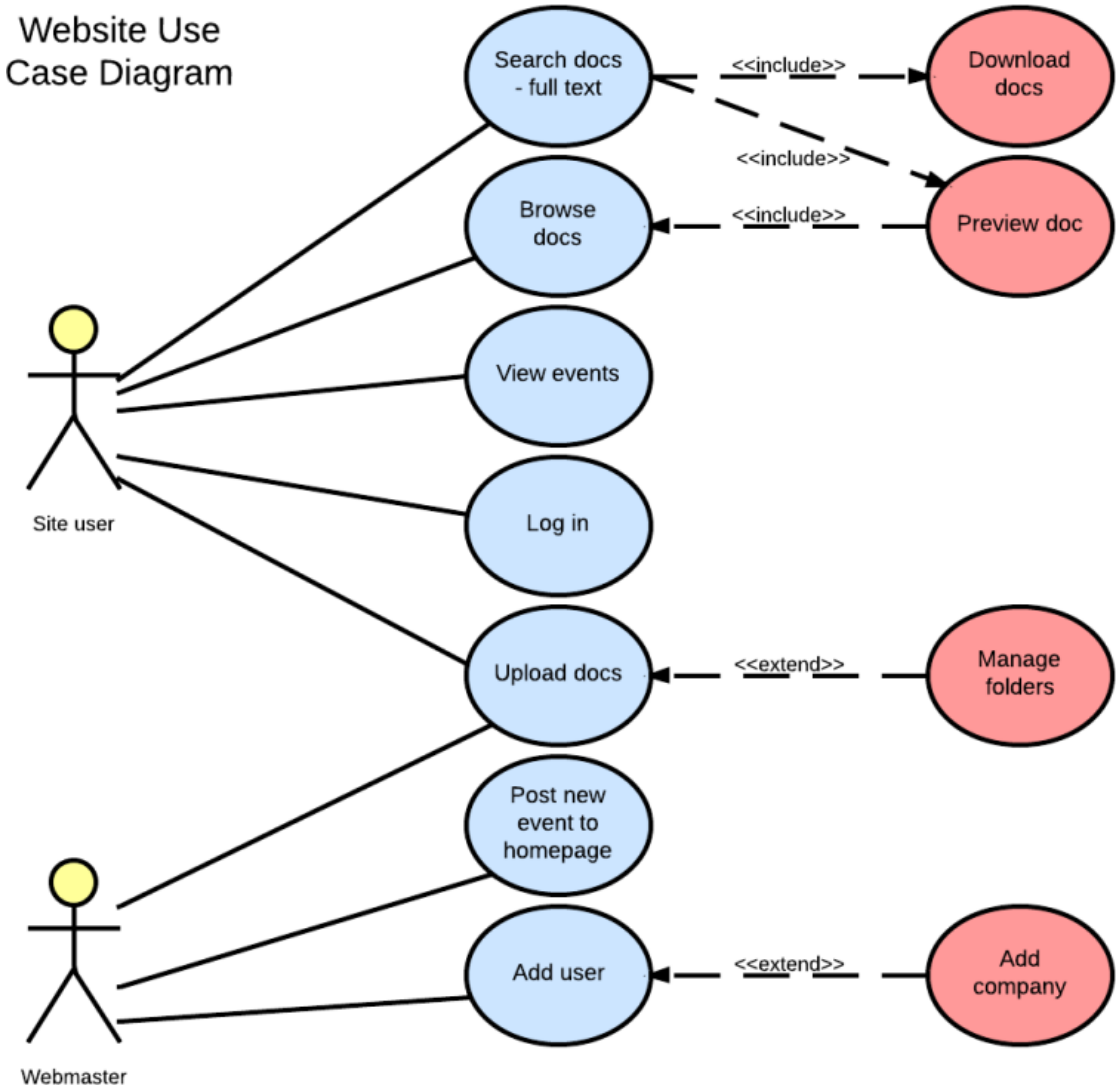

Figure 3.3 illustrate UML use case

UML, or Unified Modeling Language, is a visual modeling language that helps software developers visualize and construct new systems. It's not a programming language — it's a set of rules specifically for drawing diagrams. It helps software developers visualize, construct, and document

new software systems and blueprints. UML is used to create static structure diagrams based on a variety of engineering practices that have proven to be successful in the creation of complex systems.

3.2. Research Design

Methods and strategies employed by a researcher at different phases of the investigation are reflected in research methodology. Developed by Vaishnavi and Kuechler, the general research design technique was employed in this study. Awareness of a problem, suggestion, development, testing, evaluation, and conclusion are its five stages. Subsections that follow provide a detailed explanation of each step.

3.2.1. Aware of A Problem

The system framework, which is based on web programming languages, intends to modernize the administration of educational institutions by substituting electronic registration and management systems for paper-based operations. It aims to lower errors and streamline procedures by addressing issues including form completion, verification, and record-keeping. An intuitive user interface, the flexibility to scale to accommodate massive data quantities, and administrator access control are important aspects. In order to guarantee effective and secure management of student information, it addresses typical problems such as challenging user interfaces, inadequate internet access, usability, scalability, and security concerns.

3.2.2 Suggestion (Solution)

At this stage and after identifying the problem, the stage of proposing solutions to this problem begins. This stage is considered one of the important stages, especially since it is considered a treatment for the disease, as the success or failure of the system is based (depends) on this stage. The solution proposer must take into account the strengths and weaknesses of this (proposed) treatment.

3.2.3. Development

The field of data organization and human resources management have experienced significant transformations in educational and service institutions due to the advancement of contemporary technology and the growing reach of networking and communications. Numerous creative methods have been developed in the domains of organizational and financial management, as well as statistical operations, to make these tasks easier , and those methods are:

1. Requirement Analysis and Planning

- **Identify Stakeholders**: Engage with university administrators, faculty members, students, and IT staff to understand their needs and expectations.
- **Define Requirements**: Outline the functionalities needed, such as student registration, course selection, professor assignment, and scheduling.
- **Set Objectives**: Establish clear goals for the system, including user experience, data accuracy, and system performance.

2. System Design

- **Architectural Design**: Choose a suitable architecture for the system. For example, a client-server architecture where JavaScript

(with frameworks such as React or Angular) handles the front-end, and SQL Server manages the back-end.

- **Database Design**: Design the database schema in SQL Server to manage tables for students, courses, professors, schedules, and registrations. Normalize the database to reduce redundancy and improve efficiency.
- **User Interface Design**: Create wireframes or prototypes for the user interface using tools like Figma or Adobe XD. Ensure the design is intuitive and user-friendly.

3. Technology Stack

- **Frontend Development**:
  - **JavaScript**: Use JavaScript for dynamic content and user interactions. Frameworks/libraries like React, Angular, or Vue.js can enhance development efficiency.
  - **HTML/CSS**: Use HTML for structuring web pages and CSS for styling them.
- **Backend Development**:
  - **Node.js**: Use Node.js for server-side scripting if needed, especially if using JavaScript on the server side.
  - **SQL Server**: Design and implement the database schema, write SQL queries for CRUD operations (Create, Read, Update, Delete), and ensure data integrity and security.
- **APIs**: Develop RESTful APIs to facilitate communication between the frontend and backend.

4. Implementation

- **Frontend Implementation**: Develop the user interface based on the design specifications. Implement features like registration

forms, course selection, and scheduling using JavaScript and related frameworks.

- **Backend Implementation**: Set up SQL Server, implement the database schema, and create APIs to handle data transactions. Ensure that the system handles requests efficiently and securely.
- **Integration**: Connect the frontend with the backend via APIs. Test the integration to ensure smooth data flow and functionality.

5. Testing

- **Unit Testing**: Test individual components (both frontend and backend) for correctness.
- **Integration Testing**: Ensure that all system components work together as expected.
- **User Acceptance Testing**: Have end-users test the system to validate that it meets their needs and expectations.
- **Performance Testing**: Assess system performance under load to ensure it can handle the expected number of users and data volume.

6. Deployment

- **Server Setup**: Configure the server environment for hosting the application, including setting up SQL Server.
- **Deployment**: Deploy the application to the server, ensuring that all components are correctly configured and accessible.
- **Data Migration**: If transitioning from a paper-based system or another software, migrate existing data to the new system carefully.

7. Maintenance and Support

- **Monitor**: Regularly monitor the system for performance, errors, and security issues.
- **Update**: Implement updates and improvements based on user feedback and technological advancements.

- **Support**: Provide technical support to users and address any issues that arise.

8. Documentation and Training

- **Documentation**: Prepare comprehensive documentation for both users and developers, including system functionalities, troubleshooting guides, and API references.
- **Training**: Conduct training sessions for university staff and students to familiarize them with the new system.

Effective data management system design is one such area of concentration for student registration platforms, which depend more and more on multimedia apps to satisfy the demands of higher education institutions. The challenges and limitations that are inherent in the old-fashioned tools have paved way to the transfer from paper based systems to computer based systems. Some of the issues with paper-based systems are issues to do with duplication of work, inefficiencies, inappropriateness, irregularity, and high levels of seclusion together with security threats. Hence there is a need to apply modern methods and techniques that will ensure effectiveness and accuracy of the students' data management. From the needs of the population of the graduate students of Tikrit University specifically, this research presents an overview of the method and measures to cope with the barriers faced in student registration. With IEPs of the given format, the registration procedure can be fully mechanized, and students will be able to register for their prescribed subjects by deploying the said approach. Also, via the website, students will be able to choose their teachers, courses, and the times of lectures. Concerning the specifications for implementing the above solution, the two main languages that can be used are JavaScript and SQL Server. JavaScript makes the interactive part possible making

the registration more comfortable and clear. On the other hand, when it comes to the storing and retrieving the data SQL server has a solid base of handling the data and making it secure, easily accessible and manageable. The solution proposed for increasing the effectiveness of student registration procedures aims to incorporate these technologies. Another advantage of multimedia application integration will be improvements in user experience since , it will further contribute to the platforms' easy-to-use nature.Thus, in general, it can be understood that Tikrit University and other similar educational institutions will be able to bring the methods and techniques offered in this paper into practice to improve the student registration system. It therefore implies that they can optimize their processes and, in the long run, increase the academic productivity and the students' satisfaction through embracing of ICT solutions and innovations.

3.2.4. Testing

Such measures are taken to ensure that it is dependable, secure, and performs optimally and to accomplish these several tests shall be conducted. Now , during this phase of testing, the testing methodologies that are going to be used are unit, integration, system and security testing. Where integration testing examines operations from the integrated system's perspective, unit testing examines the functionality of each unit. Integration testing will extrapolate on whether or not the system works well in an integrated environment , while system testing will look into the ability of the system to perform under real life circumstances. Also, security testing will identify vulnerabilities that will be corrected to ensure the prevention of leakage or unauthorized entry on the student data. As a result, all the problems or limitations with the given system can be uncovered and resolved before it is used on a business level. It will

also try to implement the solution from the grounds up to match the expectations of Tikrit University and the positive aspect of having a fresh and reliable student registration and information storage platform.

3.2.5 Evaluation

Thus, it is necessary to consider means and ways of the suggested system considering its perspectives, effectiveness, and applicability for the requirements of Tikrit University. The assessment procedure will encompass multiple crucial elements , as follows:

• **Functionality Testing:** In this stage, it will be seen if the system meets its intended purpose that is; the student will be able to schedule lectures, select professors and courses, and register for subjects easily. The functionality testing will verify if there are no more critical defects/bugs and that all functions work well.

• **Usability Testing:** This form of testing will focus on the kind of experience that is received by end users towards the system. But it will evaluate how easy or complex it is for the graduate students to make preferences, to undertake activities, and even to register. Feedback will be taken from users and analysis of their feelings to note the aspects they would wish to see changed.

• **Performance testing:** This sort of testing aims to determine the dependability of the system as well as the impact of the usage rates of the system in periods of congestion. To ensure the emphasis is on the dependability of the system so that adequacies and percentages do not reduce after implementation, the success measures are response times, system load capability, and scalability.

• **Security Testing:** However, needed for security testing is to determine how susceptible the system is to threats and vulnerabilities which can potentially hazard the system. It will assess whether the measures adopted

to lock down student details, the encryption measures put in place, and whether the levels of authentication sufficiently shield the students' details from exposure and from unauthorized access.

• **Integration Testing:** This process also confirms that all the parts of the system combine to act as a single whole. It will make sure that accurate data is retrieved and saved in the SQL Server base and JavaScript within the interface operates correctly.

•**Users Acceptance Testing (UAT):** To simulate the real-life conditions during the testing UAT involves real live customers and they are graduate students, instructors and the administrators. We shall gather this feedback in order to know whether the system meets or does not meets the expectations of the users as well as the area that require more enhancements .The efficacy and appropriateness of the suggested system for Tikrit University can be evaluated by carrying out a thorough assessment that takes into account these crucial factors. A smooth and effective deployment can be ensured by addressing any problems or shortcomings found during the evaluation phase prior to the system being deployed in a production setting.

3.3 Summary

The approach employed for this investigation is described in this chapter. An in-depth explanation of our approach is provided in order to accomplish the research goals. The steps of the study methodologies include problem identification, literature review analysis, and system construction. The planned technical will be used in practice, test and result analysis, performance evaluation, conclusions and recommendations round up the next few chapters.

Chapter Four

Experimental Results and Evaluation

Chapter Four

Experimental Results

4.1 Introduction

This chapter provides the results obtained from the suggested system application (Design and Implementation of a data management Model for Graduate Students). This system (postgraduate student registration platform) was designed using the JavaScript language, specifically one of the JavaScript language libraries, which is the React library, which is a declarative, efficient, and flexible JavaScript library for building reusable UI components. It is an open-source, component-based front-end library responsible only for the view layer of the application. It was created by Jordan Walke, who was a software engineer at facebook. It was initially developed and maintained by facebook and was later used in its products like whatsApp and instagram. Facebook developed ReactJS in 2011 in its newsfeed section, but it was released to the public in the month of May 2013.

4.2 Methodology Implementation Results

The suggested system includes four main components and each component performs a specific function to make the proposed system work correctly. These components are interconnected and compatible with each other and complement each other. One of the components in this system cannot be dispensed with. The four components are:

4.2.1 Home Component

This component is specific to the home page, and the following tools are used to programming this component:

- **react-router-dom**: Link is imported to create a link to navigate between pages.

- **Navbar**: Import navigation bar component.
- **CSS**: Import the home.css file to style the page.
- **HTML** : is the standard markup language for Web pages. With HTML you can create your own Website.

Brief explanation: The component contains a section that displays an overview of the platform and an option to go to the registration page using a Link.

4.2.2 Subjects Page Component

This component is concerned with presenting the academic subjects and the number of units for each subject. There are several tools used in this component (part), and these tools are:

- **UseState, UseEffect**: To manage different states (such as selected subjects, current course, modules, registered student) and execute side instructions.
- **UseNavigate**, useLocation: To navigate between pages.
- **Sweetalert2**: To display sweet alerts.
- **Context**: To manage student status across components.
- **Local storage, Session storage**: To store and retrieve student data, selected materials, and modules.

4.2.3 Professor Page Component

This part (component) is concerned with choosing a teacher for the academic subject from among a group of teachers and the appropriate time and day that suits the student ,and this window consists of the same components as Window (Subjects Page Component) in Paragraph 4.2.2

4.2.4 Print Page Component

This part (component) is concerned with sending the student's information that he chose within the previous pages to the admin page, as well as printing a PDF copy, and uses the following tools for this purpose:

- **UseState, UseEffect**: To manage various states (such as student information, timetable) and execute side instructions.
- **UseNavigate, UseLocation**: To navigate between pages.
- **Sweetalert2**: To display sweet alerts.
- **JsPDF, Jspdf-autotable**: To create PDF files containing the timeline for importing fonts and images for use in PDF files

The bottom line is this **,**Many tools and libraries are used in these components to create an interactive and flexible user interface, while handling various problems such as login verification, loading and saving data, checking for conflicts, and creating PDF files. These tools include React, react-router-dom, sweetalert2, jsPDF, and others.

The figure below shows the components and tools for each component:

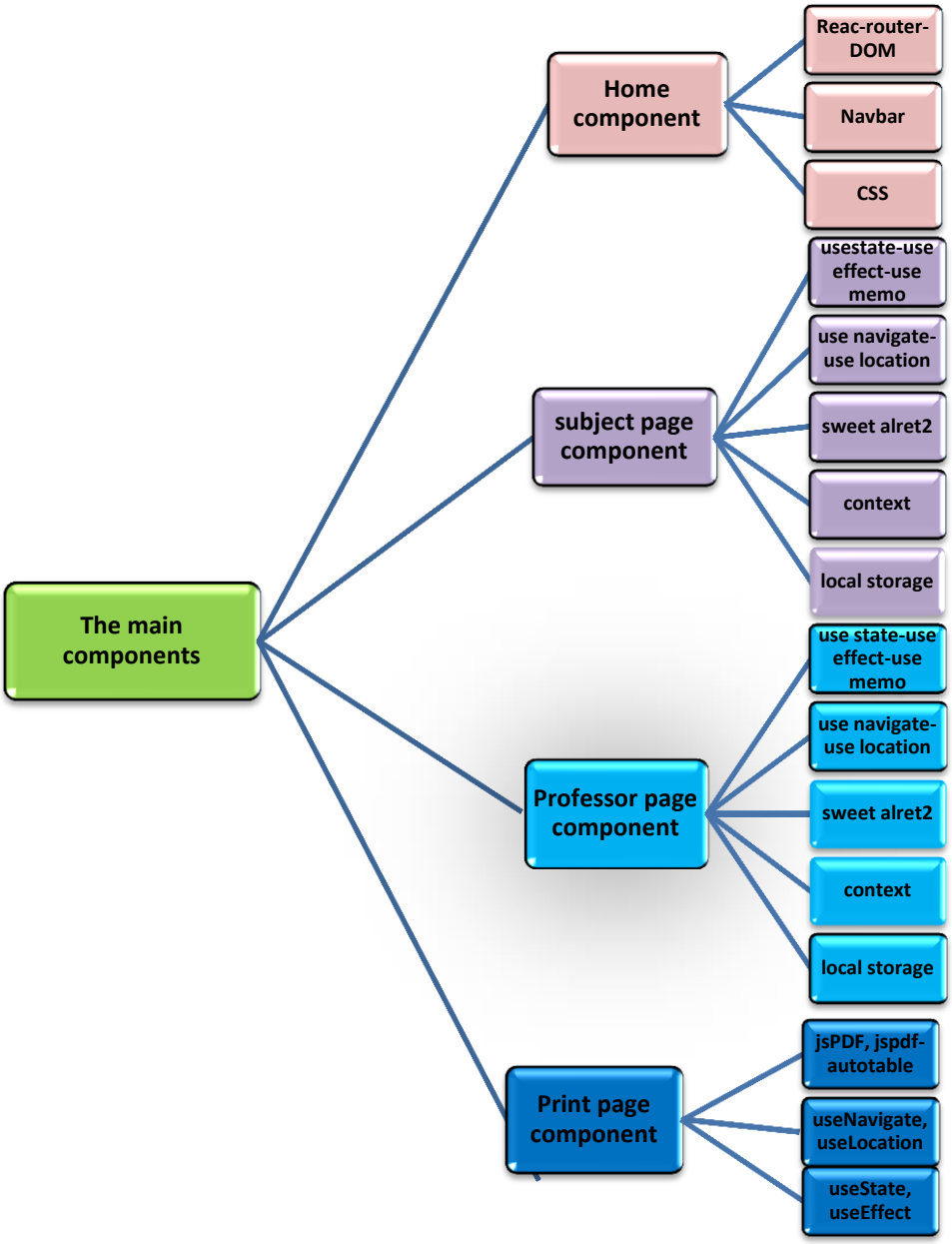

Figure 4.1: the main components for system

4.3 The system interface

The beginning designs the main interface which contains a brief explanation of the platform for registering graduate students in the College of Computer Science and Mathematics at Tikrit University. It also contains a button to enter the platform, as shown in figure below:

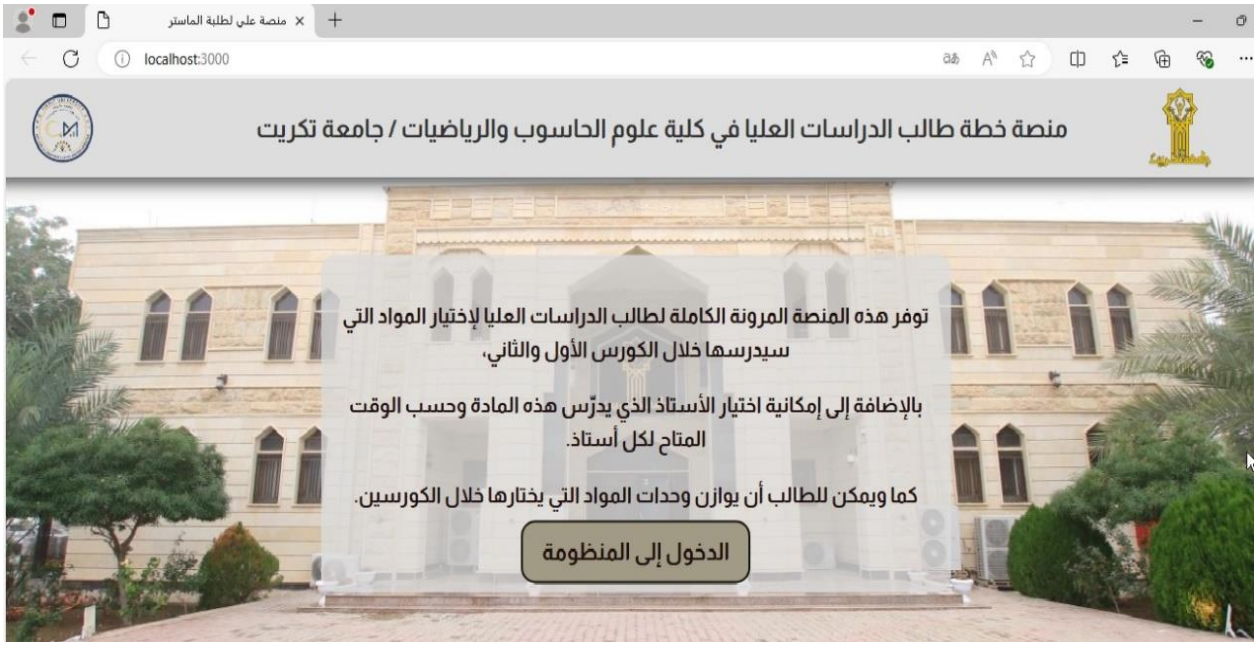

Figure 4.2: main interface for platform

When you press the button to enter the system the following window will appear

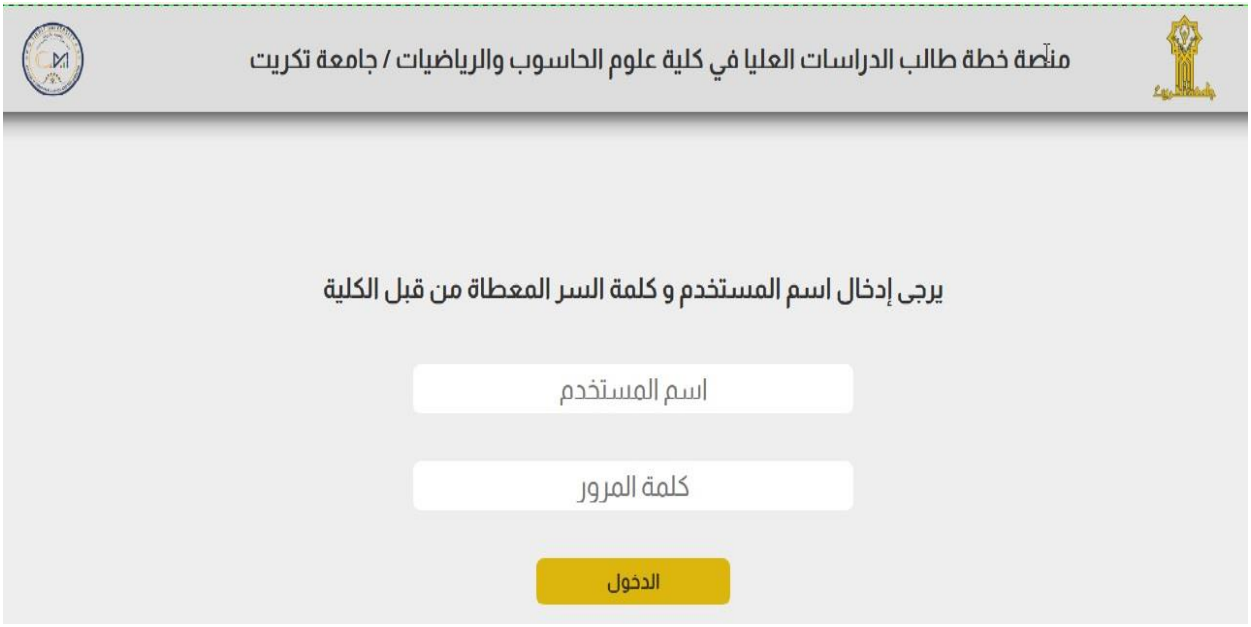

Figure 4.3: entering to subjects form

The student enters the user name and password given by the college, then enters the window for choosing the study subjects for the two courses and the number of units, Since the College of Computer Science and Mathematics at Tikrit University consists of two

departments, the Computer Science Department and the Mathematical Sciences Department, there are special usernames and passwords for each department, meaning that students of the Computer Science Department have their own usernames through which they can access the study material platform of the Computer Science Department. Likewise, the students of the Mathematics Sciences Department have their own usernames and passwords through which they can access the study materials of the Mathematics Sciences Department, as shown in Figures below:

Figure 4.4: computer science subject's form

Figure 4.5: mathematic subject form

These windows at the top contains several elements, including the student's photo, the student's name, the department, the names of the academic subjects and their number of units, the number of units for each course and the number of total units. It also contains two buttons, one for the next window and the other for logging out. In this window, the student must choose six subjects and balance the subject units. The student must choose the subjects and their number of units equally between the two courses. There are also subjects that are required to be taught in the first or second course, as required by the department. If six subjects are not selected or there is an imbalance in the number of units for the two courses, a warning message will appear according to the reason . If the student does not choose six subjects and clicks the next button, the warning message appears as shown in the figure below :

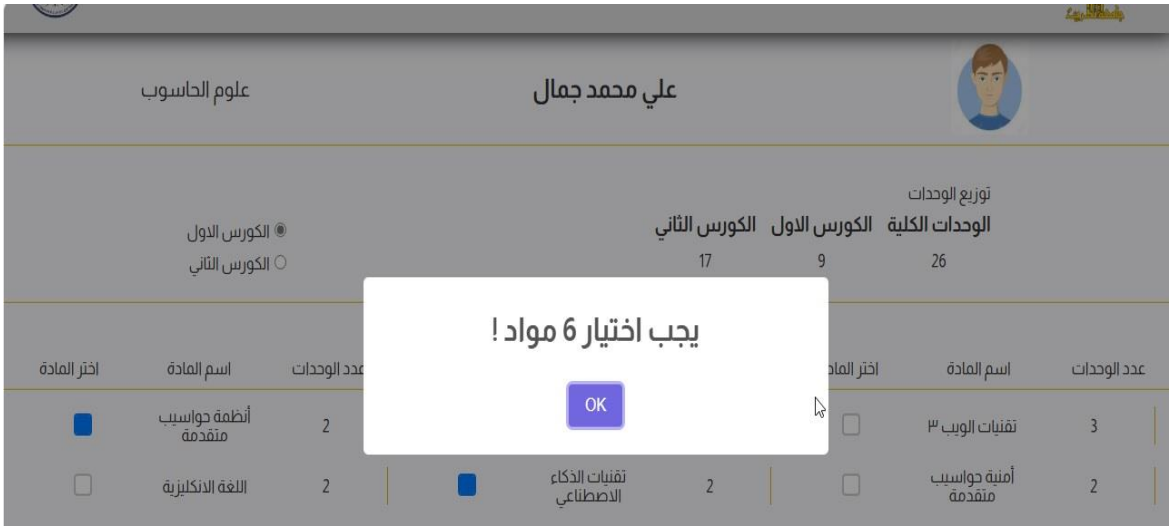

Figure 4.6: warning massage1

However, if the student in the first course chooses subjects with units that are not equal to the subjects in the second course, the following warning message will appear:

Figure 4.7: warning massage2

We note in that warning message that the number of units must be 13. Here we mean that the number of units for the course must be 13 because the total number of units for the two courses is 26, and as we mentioned previously. The number of units must be equally divided between the two courses. If the student's choice of the number of subjects and the number of units is correct, then when he clicks the next button, the professors'

selection window will appear, as shown in the figure below:

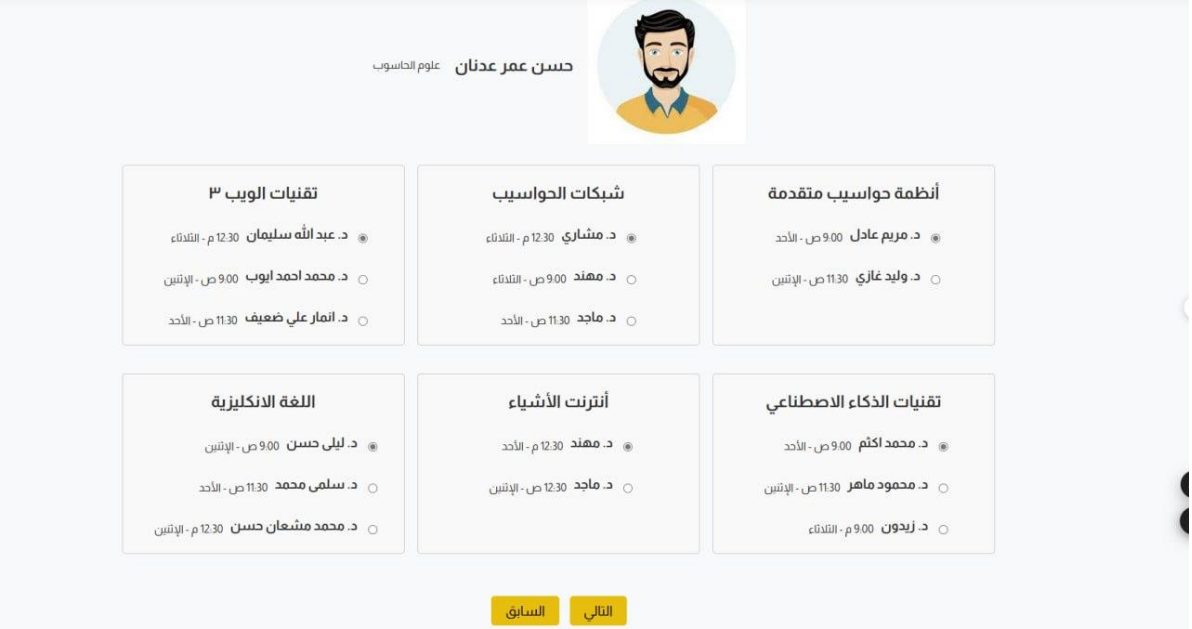

Figure 4.8: Professor selection form

The window above (the professor selection window) contains the academic subjects and the professors who teach each subject, as there is more than one professor for one subject, and each professor has his own time and day to teach that subject. Here , the student has the right to choose the professor among several professors who he wishes to teach that subject, and he also has the right to the student can return to the previous window and modify his choice of subjects using the Previous button. He can also, selecting the professors after he goes to the next window (the window for the selected subjects, teachers, and appointment schedule) via the next button. We also notice in this form that some professors teach more than one subject, and therefore you should not interrupt during lecture times, and this is what was taken into consideration in this system.

After choosing the professors (after the student chooses the appropriate professors) and clicking on the next button, the next window appears, as shown in the figure below:

Figure 4.9: The final form for the student's choice

This window contains the student's name, department, course, and total number of units for the course. It also contains a table consisting of five columns that include the name of the subject, the number of its units, the teacher of that subject, lecture day and lecture time which was taught. It also contains two buttons, one of which is for printing (printing the selection file in PDF format) as shown in figure (4.10) and sending the file to the system administrator page and the other button to return to the previous page and modify the selection.

اسم المادة	الوحدات	التدريسي	اليوم	الوقت
أنظمة حواسيب متقدمة	2	د. وليد غازي	الإثنين	ص 11:30
شبكات الحواسيب	2	د. مشاري	الثلاثاء	م 12:30
تقنيات الذكاء الاصطناعي	2	د. محمد اكثم	الأحد	ص 9:00
برمجة متوازية	3	د. سلوى	الثلاثاء	ص 9:00
علم البيانات	2	د. سلوى	الأحد	ص 11:30
اللغة الانكليزية	2	د. ليلى حسن	الإثنين	ص 9:00

Figure 4.10: PDF format for the student's final selection

4.4 System testing

After designing the system with all its interfaces using the tools available for each of the four components mentioned above in paragraphs 4.2 and 4.3 . The system was examined by taking default values (data) and entering them into the proposed system, where correct results are obtained for those entered values, as the system it currently works in front-end format, and it can be made to work in both front-end and back-end formats, by connecting it to the network and reserving a special website for that, after which real data can be entered and sent to the admin page (dashboard).

4.5 System evaluation

The system is evaluated by some experts as well as some users. The easier system is to use, the more secure it is, and the more it meets the needs of all beneficiaries of this system (graduate students, professors, and college), the better system. There are several criteria for evaluating the system . There are several key criteria can be considered , as follows:

- **Functionality**
- **Data Management**
- **Integration**
- **Efficiency**
- **Security**
- **Scalability and Flexibility**
- **Impact and Contribution**

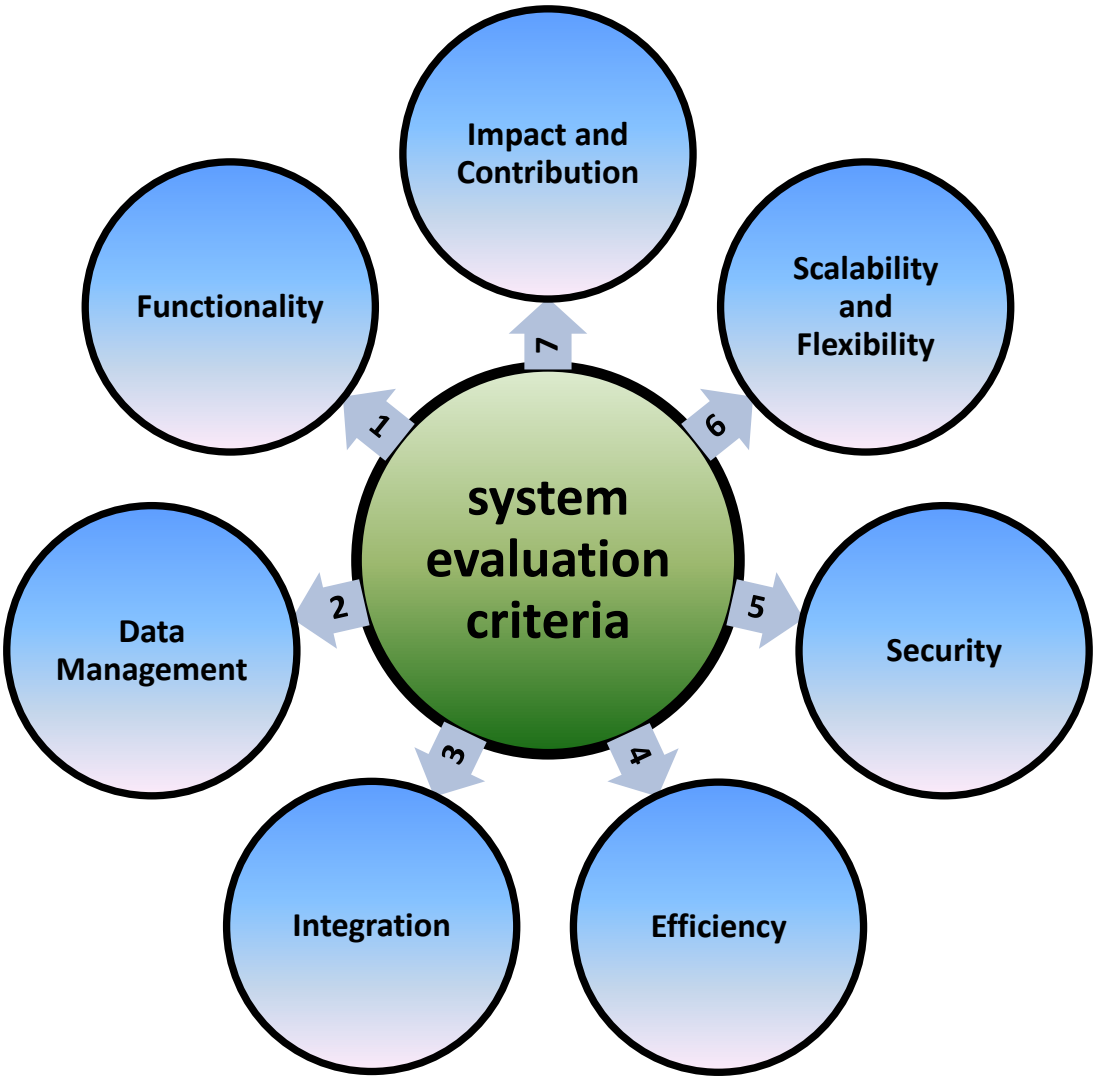

Figure 4.11: system evaluation criteria

4.6 System maintenance and development

After the system evaluated by users and experts, the process of maintaining and developing the system carried out by the system designers to meet the needs of the users and those in charge of the system, as well as to keep pace with the development taking place in modern technologies.

4.7 Pros and challenges of this system

For any system in this universe, there are positives and there are challenges. Most of the positives of this system were included in some of

the paragraphs above, such as efficiency, speed, accuracy, ease of access, reliability, dependability, integration, etc.

The most prominent challenges of this system in Iraq, especially Tikrit University, are as follows:

1- The small number of professors teaching graduate students.

2- The lack of different specializations, and the large number of professors who have the same specialization, which makes the professor teach a subject that is not his specialization.

3- The college sometimes imposes on some professors to teach a particular subject without the rest of the professors.

4- Most of the teachers hold a master's degree, and therefore those with a doctorate degree are required to teach.

4.8 Summary

In all of the above, this system (the platform for registering graduate students in the College of Computer Science and Mathematics), which was designed using React, which is one of the JavaScript, HTML, and CSS language libraries, provides the student with ease and speed in selecting study subjects and choosing the professor for each subject and his time. This system is used in most Western and East Asian universities. In this system, simple interactive interfaces were designed to make it easier for the student to make choices.

Chapter Five

Conclusions and Recommendations for future work

Chapter Five

Conclusions and Recommendations for future work

5.1 Conclusions

In summary, human resources management and data organization have undergone tremendous change in educational and service institutions due to the development of contemporary technology and the widespread effect of sophisticated networking and communication techniques. Nowadays, universities and other educational institutions throughout the world are in dire need of effective data management systems for student registration platforms—especially those that make use of multimedia technologies.

With the numerous drawbacks of these outdated approaches—such as duplication, imprecision, inefficiency, inconsistent results, restricted accessibility, and security flaws—it is vital that paper-based systems be replaced. In the current thesis a complete registration system and policies have been introduced that support the automation of graduate student registration in collage of computer science &mathematics of Tikrit University to get over these problems ,keep students ID differentiate, storing final information about student safely as will presented. This proposed solution involves increasing productivity and ease of use by facilitating the immediate enrolling of students in particular subjects, professor selection, course scheduling & lecture time management. In this case, schools can improve their registration process and make it faster while saving time for them which makes the institution more organized but how , because they are utilizing technologies such as JavaScript also SQL Server greatly from reducing financial costs (time-labor). By implementing this advanced technology and techniques educational

institutions like Tikrit University can improve their data management procedures to provide more efficient and safe environment for all students. The use of these recommended processes and procedures is a significant step toward papers to sign up for college utilizing improved student registration systems, along with other potential benefits like multimedia applications in school administration.

When push comes to shove, keeping pace with the shifting requirements of educational establishments and ensuring smooth-running processes in an increasingly digitized landscape largely relies on how well-designed and effectively implemented their student registration systems are.

5.2 future work

For this thesis, there are chances to improve the design of the student registration system and how it handles data. Here are some ideas for future improvements:

1. Getting User Feedback and Making Changes: Ask students, teachers, and staff what they think about how easy the system is to use, what it can do, and how well it works. Use their feedback to make the system better.

2. Adding More Technologies: Look into using new technologies like cloud services, machine learning, or AI to make data handling better, help with decisions, and make the system work faster and handle more users.

3. Improving Security: Make the system more secure to protect student information. This could include using special codes to hide information, checking who is using the system more carefully, and regularly checking for security problems.

4. Creating a Mobile App: Develop a mobile app version of the system so that , students can use it on their phones.

5. Analyzing Student Data for Better Decisions: Use tools to look at how many students sign up for classes, which courses are popular, and how well students are doing in their studies. This information helps us decide which courses to offer, how to use our resources, and how to plan our academic programs.

6. **Making Registration Easy for Everyone:** Make sure the system students use to sign up for classes works well for people with disabilities. Follow rules that help make websites easy to use, like those from WCAG. Include helpful features like making it work with screen readers and allowing people to use just their keyboards to navigate
7. **Collaboration with Industry Partners:** Collaborate with industry partners or technology vendors specializing in student information systems to leverage their expertise, resources, and best practices in system design and implementation.
8. **Long-Term Maintenance and Support:** Develop a plan for long-term maintenance and support of the student registration platform, including regular updates, bug fixes, and user support services. Consider establishing a dedicated team or support contract to ensure ongoing system reliability and functionality.

5.3 Summary

In this research, what was done in the thesis itself and in similar theses from previous studies, review of references, etc. to complete this thesis was presented. Here it can be said that future work and technological development do not stop at a certain limit. My recommendation for future work is that this system be developed so that it is not limited to graduate students registering for their courses and choosing professors only, but it includes everything related to the graduate student, including personal information, grades, attendance, absence, exams, and exam results. Also, this system is not limited to the College of Computer Science and Mathematics at Tikrit University, but rather extends beyond all colleges. At Tikrit University and perhaps Iraqi universities. We are not able to do these future works because they are thought of in the middle of our work for this system and there was no longer enough

time to do them. Therefore, we recommend them to those who do work similar to this work.

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الخلاصة

مع تطور التكنولوجيا الحديثة واتساع وانتشار أساليب وتقنيات الشبكات والاتصالات الحديثة تضاعفت مجالات وتطبيقات إدارة الموارد البشرية وتنظيم البيانات المختلفة لتسهيل العمليات الإحصائية والإدارة التنظيمية والمالية في مختلف المؤسسات التعليمية بالدولة. والمؤسسات الخدمية. أصبح التصميم الفعال لإدارة البيانات لمنصة تسجيل الطلاب بالاعتماد على تطبيقات الوسائط المتعددة مطلباً ضرورياً وهاماً في الجامعات والمؤسسات التعليمية لما تقدمه من خدمات مهمة في تنظيم وإدارة هذه البيانات وتوفير الوقت والجهد البشري لهذه المؤسسات، والمساهمة في تنظيم العمل بطريقة فعالة وسهلة. وبما أن استخدام النظام الورقي لإدارة هذه المعلومات أصبح مهمة صعبة لأن المعلومات قد تكون زائدة عن الحاجة، وغير دقيقة، وغير فعالة، وغير متسقة، ويصعب الوصول إليها، وغير آمنة. لذلك، ومن أجل إدارة فعالة وخالية من الأخطاء لهذه المعلومات، سيتم في هذه الأطروحة اقتراح آلية وتقنيات من المفترض أن تعني كيفية تسجيل طلاب الدراسات العليا (تلقائياً) للمواد المخصصة لهم واختيار الأستاذ (المدرس) والموضوع الذي يرغب الطالب بدراسته في هذا المقرر وكذلك اختيار وقت المحاضرة المناسب وتبدأ الدراسة في جامعة تكريت. سيتم اقتراح استخدام **JavaScript** و**SQL Server** لتنفيذ متطلبات هذه الدراسة.

وزارة التعليم العالي
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تصميم وتنفيذ موديل لإدارة البيانات لطلبة

الدراسات العليا /الموديل لكلية علوم الحاسوب والرياضيات

رسالة مقدمة إلى
قسم علوم الحاسوب / كلية علوم الحاسوب والرياضيات / جامعة تكريت
وهي جزء من متطلبات نيل درجة الماجستير في علوم الحاسوب

تقدم بها الطالب
علي عطاالله يوسف

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