

Design and Implementation of Human Resource Information Systems Based on MVC a Case Study Vocational Education in Iraq

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Abstract

The qualities of human resources development systems are considered as inputs of economic and social growth. The importance of these systems is increased according to gradual transformation towards knowledge of trade and business in the most societies. Technical and professional education that aim to prepare employees at various basic levels such as labor and intermediate levels for technicians is of primary importance. In this paper the Human-Resource Information Systems in the Directorate of Vocational Education can be seen as an example of a complex system. Therefore, the paper considers HRIS as a case study for which a software system has been developed taking the Requirement Engineering approach into account. Thereafter, HRIS is designed using object oriented analysis and design methodology along with J2EE platform and a few auxiliary technologies like framework Spring helpful in implementation of MVC design pattern and Hibernate facilitating connecting process with a database. A System uses an efficient database Oracle 10g Release 2.

Keywords: HRIS, MVC, Requirement Engineering, Object Oriented

1. Background

Human-Resource Information Systems (HRIS) have drastically evolved since they were first introduced. In general, it is a software or online solution for the data entry, data tracking and data information needs of the Human Resources and reporting, beginning with recruitment and ending with retirement [4-9]. As such, HRIS facilitates the use of computer technology to streamline HR operations, cutting costs and ultimately enhances the effectiveness of human resource management. However, the present HRIS system at the Directorate of Vocational Education, Ministry Education in Iraq, involves a lot of manual feeding. The employee data is stored in simple digital spreadsheet's and various other important factors like attendance records, payroll, insurance, holiday listings *etc.*, are stored under different fields in the spreadsheet or in a simple databases. Maintaining such kind of data is quite monotonous and boring, with an associated risk of mistakes while updating such sheets. In addition, there is no sharing of information with other departments in the organization due to the lack of a unified whole system in the management process. This causes inability to meet the demand of social development.

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In this paper, a web-based HRIS is designed to have high efficiency and meet the fast pace of modern life and work needs. It also aim to have a system that is flexible and transparent among HR managers and top management. It will be used to quickly view and update employee status according to organization hierarchy. This system provides HR Information to manage the employee database as well support applications such as User Login Management (ULM), Employee Information Management (EIM), Employee leaves Management (ELM), and Employee Discipline Management (EDM).

In addition, the HRIS is founded on requirement engineering, the process of developing requirements through an iterative cooperative process by analyzing the problem, documenting the resulting observations in a variety of representation formats and underlying conceptual modeling techniques, based on the information systems. Therefore, much attention is paid to find, represent, analyze, and design such a system that support all the said features. We describe an HRIS using a conceptual model that shows how actors create, distribute, and consume objects of economic value. Its motivation is a formalized approach for exploring and modeling an HRIS explicitly, which contributes to a common understanding.

2. Related Works

Human Resource Information System (HRIS) is not a novel idea, however it is recurrent with the needs that are changing day by day. Human-Resource Planning (HRP) is a critical activity for any organization and HRIS plays significant role in this regard [10]. In [19] author stressed on Human-Resources Information Sharing System, which may include self-service (employee and teacher) in the process of daily management in the university. The deliberate advantages of HRIS includes: gathering information, processing information and making all the group workers aware of this information. Ye Z has proposed various advantages, applications and importance of HRIS [20]. He also has highlighted the implementation of a corporate personnel management system. This system has the potential to be an enterprise-wide decision support system that helps to achieve both strategic and operational objectives. Gupta claims in his study that HRIS can play an important part in a company's (HR) function [4]. Further inferring that implementing an effective HRIS can be sure fire for HR to stay on the cutting edge in its bid to deliver a more effective, and streamlined services. The research also has revealed that we can't apply HRIS to analyze things, though it shows good results in administrative tasks performance. In [16] author discussed three models for HRIS designs; first one is, basic Human Resource Information System design model, second one is hexagonal Human Resource Information System and third one is Human Resource Information System phase's model. In these three designs the author highlighted the benefits of HRIS scheming and implementation at every stage of business sphere. HR-databases or HR-Knowledge bases, containing information associated to human resource is used to retain and process the associated business projects and resolution, to predict and to manage (HR) procedure within and the outer surface of business organization.

3. State of the Art

The Requirement Engineering (RE) [1-17] process needs some additional work to be done for the sake of adjustment of current procedures to gratify mainly the vital phases of life-cycle. A repetitive supportive method of analyzing the problem and documenting the consequential interpretations for requirements engineering development somehow had been adapted and integrated in object-oriented Unified Modeling Language UML.

The Unified Modeling Language (UML) OMG (2011) [13] is the most commonly used standard tool for documentation and modeling of requirement specification. The UML structural design consists of Meta model of four layers and it gives 14 types diagrams [18] to tell about a system that how it varies in different angles or conceptual levels that facilitate to handle intricate projects and divide tasks between stakeholders. Various UML diagrams are the description of different aspects of software that is going to develop and are sturdily dependent on each other in one way or the other.

As far as the development of web application is concerned, the Model View Controller (MVC) pattern (*e.g.*, spring MVC) [5-15] is a significant structural design pattern that have been used for the preceding years [4] to guide in designing and accomplishment of web systems, because of its control logic and other properties. MVC [8] is usually seen as lightweight J2EE framework to build up, organize and handle intricate concerns related to project elucidation by using Java 2 platform [7-11]. For high accessibility, high trustworthiness and flexibility of applications, J2EE system offers an inclusive framework with middle layer for low costs requirements. With the help of unified development platform, J2EE the cost and complexity of multi-tier application development is reduced and it also provides robust assistance to integrate the currently working applications.

Spring permits various frameworks to join together to deal with the object relational mapping (ORM). Spring gave the idea in support of Hibernate, Java Data Objects (JDO), Data Access Object (DAO), (JDBC) and (iBATIS). On the view side, spring has support for a number of web content solutions including JSP, Velocity and Struts [6].

4. Developing a HRIS

4.1. Problems of HRIS in Vocational Education

The biggest problem with the current management system in vocational education is that all departments working independently but relying on human resource management, without collaborating with each other. So the automatic information conversion and sharing, does not achieve the related requirements which need to systematically combine all departments. The current system still uses the decentralized management model while the management system is mainly LAN based and a single microcomputer in the management process. The processes of the system in use are mainly independent system operations, which rarely exchange information within each department. At the same time, it wastes a lot of time and the results are not ideal.

A Large amount of information maintained lacks survey and overall optimization leads to the abnormal use of a lot of resources. This wastes manpower, material and financial resources, while at the same time, largely increasing redundancy. Once a system problem occurs, it needs the related person to repair it, so it increases maintenance costs. In addition, the system does not have its own (C /S) structure and requires a server and client in the using process.

The Lack of human involvement in daily management and human resource information management not only relates to the management employee order, but also directly affects the future development of Vocational Education. However, in the current human-resource information management system, the design has symbolically collected and manages information date, but doesn't make any reminder for the management flow and scale. For example, an employee's tenure is over and needs for renewal; the system does not promptly provide reminders. If forgotten, it will directly impact the working state and emotion on both sides. Our

proposed system will deal with all these issues in a sophisticated way with improved efficiency.

4.2. System Implementation

After the design, the next step is implementation of the system. Selection of development tools is very important for the whole system efficiency and cycle. Reasonable choice of development tools will enhance development efficiency, reduce development costs, improve system stability, as well as make the system maintenance easier. In order to facilitate system development and maintenance, the entire system uses Net-Beans IDE 7.0 as the IDE, which can well achieve the integration among Web server, database and development tools. Through integrating a large number of plugins, Net-Beans can be continually expanded to support a variety of applications, thus the software can be used to manage various development tasks. The interaction with the user's web browser is handled by the web server (Tomcat 7.0), which contains the Dispatcher Servlet and the JSPs for the HRIS. Combining Tomcat and Sun Java gives the best results and the using them in cooperation with other application servers can support the integration of J2EE standards. The main feature is its powerful function. Moreover it is free. The system uses Jakarta Tomcat as system Web server, and JDK.7 as java virtual machine. Selects Oracle 10i server database, which can increase data storage capacity and access efficiency show Figure 1.



Figure 1. HRIS Vocational Education Web-Page

5. Methodologies

This study follows the requirement engineering approach in analysis, design, and life-cycle of a web-based HRIS system. The approach determines the Requirement Specification, Requirement Analysis, and System Design approach, which is based on the specifications of the Unified Modeling Language (UML) [3-12]. It starts with

a phase called requirements capture, during which we define use cases and scenarios.

The goal of the requirements capture phase is to establish some common ground between the developers and the users by describing the system expectations. Subsequently, during the analysis and design phase, use cases will be described from diagrams. The system design is completed by describing the behavior of these cases in terms of their transition from one state to another, which is depicted in an activity diagram. During the implementation phase, the design is translated into a web application Browser / Sever (B/S) form by implementing the spring framework based on MVC prototypes.

6. System Analysis and Design

This section tackles Requirement Analysis, Requirement Elicitation, Requirement Specification, and the System.

6.1. Functional Demand Analysis of System

The overall Human Resources Information System (HRIS) divides the whole task into many basic and specific function modules; these specific function modules can be reasonably integrated to form the overall system. The system's basic tasks are described as follows:-

- Dividing the system into larger modules
- Doing a further breakdown of each function module to form more specific functional modules
- Determining the specific function of each module
- Determining the module calling relationships
- Determining the module interface and the interaction of information between modules

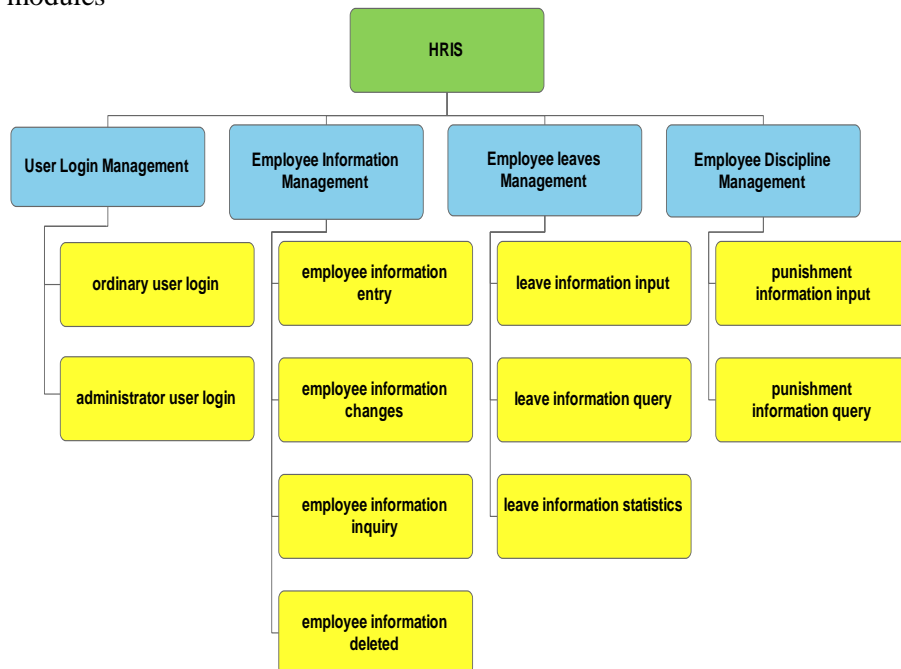


Figure 2. Functional Requirements of HRIS

The HRIS is divided into four parts; they are User Login Management (ULM), Employee Information Management (EIM), Employee Leaves Management (ELM) and Employee Discipline Management (EDM) as show in Figure 2.

User Login Management consists of ordinary user login and administrator user login. The ordinary user is one of the registered users, such as employees and so on. The administrators are responsible for maintaining and updating the entire system and have more rights on the system. Employee Information Management includes: employee information entry, employee information changes, employee information inquiry and employee information deleted. Employee Leaves Management includes: leave information input, leave information query and statistics leave information. Employee Discipline Management includes: input information punishment and query information punishment.

6.2. The Function Analysis for Modules

By using object-oriented programming technique, each module has functions which are independent. It results into designing a comprehensive program and the inclusive processing and maintenance of functional modules. There are two user logins first one is ordinary user login and the second one is administrator login. When ordinary users try to use the system, they log on and system will allow them only restricted access to the information stored in the database. For an administrator, when he log on, he have the full rights to use the system and access the information. He can check the information stored and can make the changes to the system and can maintain the system integrity. *The Employee Information Management (EIM)* is basically an information management system for employees to maintain and update their information. Employees can view their own personal information page (such as name, address, sex, minority status, etc.). When they enter into the system and try to edit or delete any other information defined by HR Policies of the organization, they cannot do so as they do not have right to access this information. They can edit personal information only as defined by HR administrators of the organization and uploads their personal photographs into the system. *The Employee leaves Management (ELM)* is the assessment of the daily work of employees. The employee worth an annual leave when he has at least one year of continuous service to be eligible for this type of leave. The employee can request another leave (maternity, satisfactory, without pay, etc.) as well as a local leave period of seven days for a while, if an employee did not complete the year on his appointment and will be in essential cases only. The employee can send request leave to the administrator after getting initial approval from the senior management for submission of the application. *The Employee Discipline Management (EDM)* persuades cooperation and synchronization between workers along with confidence inoculation in the workers. If there will be no order of the things then it definitely result into anarchy, perplexity, bribery and insubordination in an enterprise. If the employee has committed any breach, the senior management will determine the type of fence and the necessary punishment. After notifying the system administrator, such as (dismissal, written reprimand, etc.) when the employee gets on three written reprimand the administrator will notify senior management to take appropriate procedures against the employee such as separating the employee or transmission in the same or the outside institution.

6.3. Use Case Modeling

The use case model for web-based Human Resources Information System (HRIS) is depicted in Figure 3, which includes three actors. The employee, who initiates a service request and the beneficiary of the system functions. Administrators are responsible for maintaining, updating the entire system and have more rights on the system. Senior Management is responsible for the implementation decisions and feedback results of the

acceptance or rejection reports. In general, the system consists of four main use cases (ULM, EIM, ELM, and EDM).

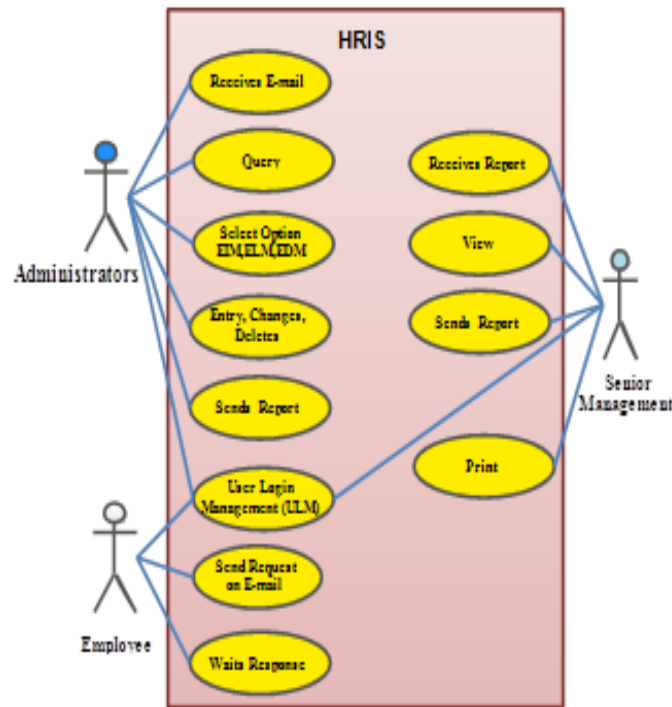


Figure 3. Use Case Diagram\ HRIS

6.3.1. Use Case Scenario UCS1: (ULM): The system allows a user to log in via a password protected. The user has to register prior to log in the application and log out. The user enters (his/her) username and password and then clicks the Login button. The system looks up the user profile using the username and checks the password. The system will log in the user and will give him low authority to meet the basic needs of ordinary users.

6.3.2. Use Case Scenario UCS2: (EIM): The employee displays personal information screen using their unique passwords. Initially, the employee should select diagnosis the personal information that he/she wants to be edited by the administrator (entry, changes, deletes, and query) and then writes request and sends by e-mail to the administrator. When the administrator completes the steps, system will send a report to senior management.

6.3.3. Use Case Scenario UCS3: (ELM): Employee writes a request for leave after obtaining approval from senior management and sends requests by email to the administrator. After the administrator receives an email from an employee, the administrator selects the leave, enters an ID number of employee and input type of leave. When the administrator completes the steps, he clicks "Send Report". The system sends a report to senior management. Employee waits for the response from the administrator.

6.3.4. Use Case Scenario UCS3: (ELM): Senior management sends written notification warning (his/her) got the sanctions on the email to the administrator. The administrator receives an email from senior management. The administrator will input type warning and

sends a report. Senior management receives report from the administrator. Employee waits for the response from the administrator.

6.4. Database Design

The database design process is divided into four stages, including analysis of user needs, conceptual models established, logical design, and physical design. The database design is shown in Figure 4.

- In requirements analysis phase, we should communicate with users, understand and analyze users' specific needs, analyses the feasibility of system design. This phase requires an accurate grasp of users' requirements and is the basis for database design. This is the most difficult phase, because the users are often not computer-related professionals. Conceptual modelling phase is a key step in database design. According to information gathered from the requirement phase, we need to convert the abstract requirement to form a solution which is independent of any database system.
- Logical design phase will convert the conceptual model to a data model supported by a database system, if it is using a relational database, designer will often choose the entity relationship diagram to describe database system design.
- Physical design stage is to select a suitable physical structure for the logic model and implement it.

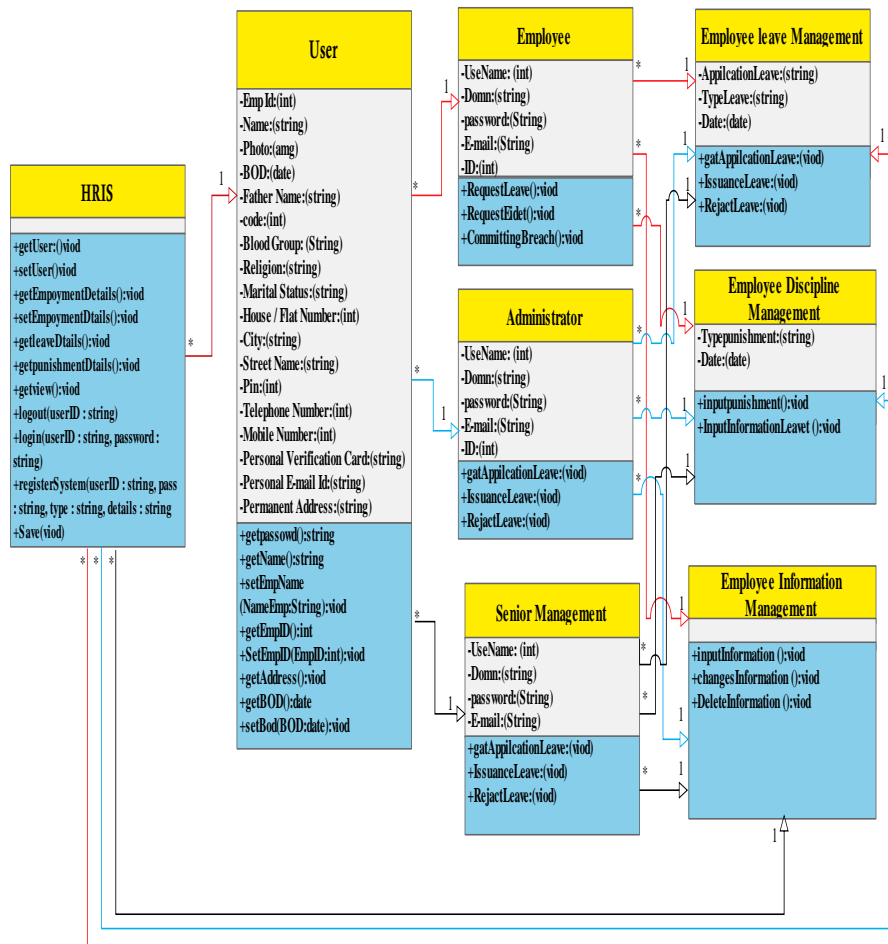


Figure 4. Class Diagram HRIS

6.5. Topology Structure of System

The information collected through the above modules will be maintained in a centralized server and could be accessed through the Internet and LAN is used to connect all offices; their network would be utilized in case of implementation. The information collected through these process related activities are maintained as follows.

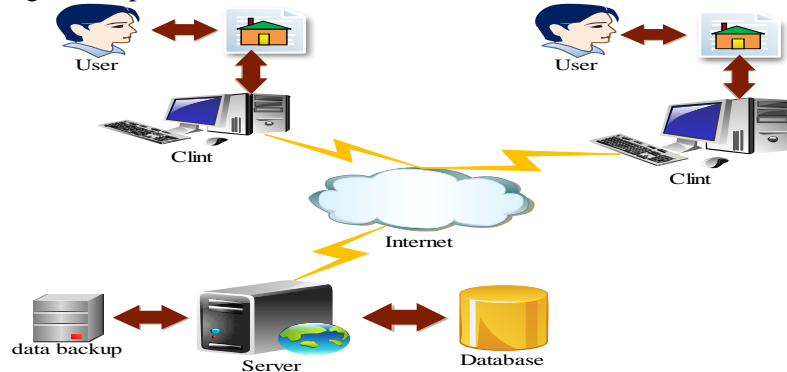


Figure 5. Topology Structure of HRIS

6.6. Design Intention

The design of the platform is based on the spring framework's Dispatcher Servlet and MVC [14] model combining with the Hibernate technology that is used to achieve the ORM adopted in this system. The most significant feature is that each layer is only dependent on the layer directly beneath it. In this way the coupling of the system is reduced and the maintainability of the system is increased. The Hibernate guides development is a completely object-oriented concept, which liberates the programmer from much of the repetitive work. Hibernate is responsible for the mapping between Java objects and relational data are a bridge between the application and the relational database, which can reduce the SQL statements required by developers through the JDBC. It also provides flexible business logic [11]. Therefore, the system established through the combination of spring and Hibernate, not only conforms to the MVC design pattern, but also conforms to the multi-story structure of J2EE platform. At the same time, it makes the system design have lower level coupling and higher maintainability and scalability.

6.7. System Framework Design

The design program based on spring and Hibernate is adopted to grasp the human resources information system. The specific processes are as follows:

The HTTP protocol communication between web browser and the application layer refers to receive user input and return the results to the user through HTTP Request and HTTP Response respectively. The Dispatcher Servlet of the application layer will transmit the client request after encapsulated to the controller and then controller will complete the corresponding logic operations through transferring Java Bean. Finally through the JSP component, dynamic web pages are generate and returned to web browser, through the data access objects DAO. Business logic layer will interact with data persistence layer, in which business logic layer provides the DAO interface and the data persistence layer provides the DAO implementation.

When the implementation framework of the data persistence layer is changed, the work of the business logic layer will not be affected, thus the system flexibility and maintainability will be further improved. The persistence layer is responsible for the communication between the logical processing layer and the database. Hibernate realizes

the DAO interface of the business logic layer and realizes the conversion and calls between Java classes and database according to configuration files information [2].

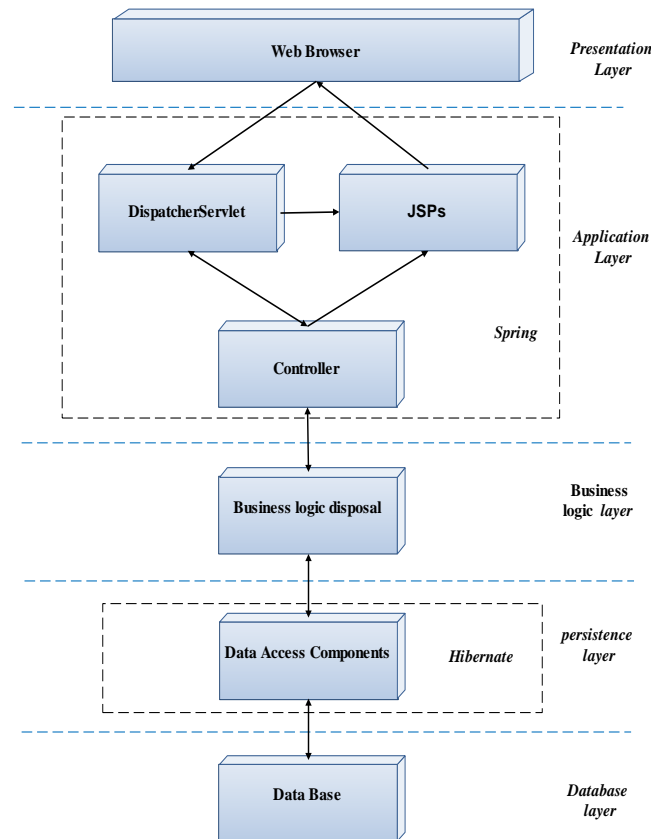


Figure 6. Deployment Diagram Design Framework of HRIS

7. Conclusions

We have showed the state of the art of requirements engineering in modern techniques applied for the development of an HRIS system in this paper. For this reason, different stages of the system development life cycle were carried out. Considering the issue, reviewing the literature, analyzing, elucidating, design and implementation, provides the proposal of life cycle study. The intention behind planning of a new HRIS system at the Directorate of Vocational Education; Ministry Education in Iraq, was to eradicate the amount of labor-intensive and facilitating the workers to have right of entry to their own HRIS, as well as share information with other departments in the organization.

A Web-based HRIS is a large complex system due to the iterative nature of requirements engineering and there maybe need to change the requirements based on future realization. Therefore, in this work, we started describing the structure of the requirements engineering process and the most common techniques used in such a process in the classic software development for non-web applications. The main activities in the process include: elicitation (capture), documentation, and analysis of requirements. The techniques most frequently used to achieve these are solicitation for use cases and scenarios, issuing of questionnaires, prototyping, etc. In a second step, a clearer picture of the future HRIS system was obtained using architecture methodologies for the web that describe how these approaches cover the aspects related to requirements engineering. We used the Spring MVC framework and J2EE standard platform technology; flexible and highly effective technology. It was shown that the system framework not only successfully resolve a large number of practical problems the enterprise human resources management

faces in improving efficiency, but it is also simple and easy to implement, having strong features such as easy expandability, maintainability, flexibility and is very secure.

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