Design and Implementation of Electronic Enterprise University Human Resource Management System

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Abstract. Electronic Human Resource Management System (EHRMS) is a paperless-based system, which plays a vital role in facilitating organizational processes, overcoming all obstacles of a paper-based system, reducing cost, time, and efforts, enhancing the quality of services (QoS), and providing more accurate data. In addition, it is beneficial for competitive advantages and it eases the tasks of the HR managers to make decisions. In this paper, an efficient EHRMS is proposed, designed, and implemented. The system is called Enterprise Electronic University Human Resource Management System (EEUHRMS). The proposed system consists of fourteen modules that provide four groups of services. The first group is related to applicant services: Online Recruitment. The second group is related to staff services: Registration, Acknowledgements/Punishments, Annual Premium, Leaves, Leave Deduction, Archive, Dispatch, Extra Fees, Salary, and Service Summary. The third group is related to institutions and presidency services: Post and Statistics. While the fourth group is related to university services: Authentication and Statistics. The proposed system is evaluated by using the System Usability Scale (SUS) to get results via specific questionnaires that are checked by the university staff. The evaluation score of the questionnaire was about (85) which is considered a good result. The proposed system is developed using the Laravel framework.

1. Introduction

The rapid changes environment increases the data of the large-sized enterprises. Also, it becomes difficult to deal with such a quantity of data related to all staff with an increasing need to store, process, and retrieve these data easily and quickly at any time-saving cost and time with minimum error. For this
reason, it is necessary to implement an electronic system with the capability of solving slow-processing problems such as Human Resource Management (HRM) to meet the challenges of the recent companies [1], [2]. However, to manage Human Resources efficiently it is worthy to utilize an electronic system in an enterprise process to meet the requirements of the enterprise [3], [4]. Therefore, the companies' trend towards employing Information Technology (IT) to manage the rules and actions of HR, it means a computer-aided HRM that advances from technology powers [5]. The HR department is an automation of the Human Resource Information System (HRIS) [6]. The objective of HRIS is to optimize HRM in firms [7], [8]. The practices of HR have been turned from HRIS to Electronic Human Resource Management (EHRM). In other words, the organizations are relay on the automating services for the employees and managers [6]. For Enterprise System (ES), the HR functions have been changed with the advancement of IT; it improves decision making, administrative efficiency, and information sharing [9]. In the 1990s the term EHRM was firstly used and emerged; it means HR transactions over the Internet and other technologies [1]. EHRM can be defined and called in various ways for instance ‘electronic HRM’, ‘online HRM’, ‘EHRM’, ‘web-based HRM’, ‘virtual HRM’, ‘computer-based HRM’, ‘digital HRM’, ‘HRIS’ and ‘HRIT’ [6]. EHRM is described as ‘the application of computers and telecommunication devices to collect, store, retrieve, and disseminate [HR] data for business purposes’ [10]. The objective of EHRM is to afford available knowledge to managers and employees anytime and anywhere [1]. Hence, EHRM is used in different aspects. For example, it has a potential role in health and is utilized frequently as an electronic hospital (e-hospital) [11], [12]. Also, it is utilized in the education area aiming to render information and services for learners and instructors in the learning/teaching purposes (E-Learning) [13]. EHRM systems make HR more strategic, flexible, cost-effective, enhancing decision-making, reducing the efforts of administrators, speed response time, enhancing users’ services, and increasing productivity [14]. In the informatization era, the construction of EHRMS has become an inevitable choice of enterprises in order to improve their core competitiveness [15]. The electronic system participates in facilitating the workflow of an enterprise by saving cost and time compared to performing the same processes manually and that will lead to a computerized and economic environmental enterprise [16]. Nowadays, some countries tend to apply electronic systems in many fields such as industry, management, education, and the health care sector aiming to transform to E-Government [11].

The main trend of this paper is to implement an Electronic Enterprise University HRM system (EEUHRMS), which encompasses Employee Recruitment, and Staff (Registration, Dispatch, Extra Fees, Authentication, Salary, Acknowledgements/Punishments, Annual Premium, Post, Leaves, Archive, and Summary Service). Moreover, the proposed EEUHRMS focuses on managing the mechanism of human resources and works electronically through the presidency directorates and the related units that belong to the institution. The handling of monetary and organizational activities for every private or public university could be expedited, also transforming approaches depended via the staff to automated style. However, the proposed is more economic, timesaving, and spending minimum exertion. Consequently, it may be dependent continually for other Iraqi ESs, moreover, this system capable of reorganization with respect to selected ES requirements within the recorded-period. Finally, the scope of this paper is limited to presenting full analytical considerations related to the Human Resource Management System electronically.

2. Related Works
Due to the HRM's role and advantages, numerous varieties of studies make a point of HRs management in recent. Efficient HRM contributes to increasing the productivity of the organization and improving the staff capacity to respond to the rapid changes of the organization. Hence, the present literature review presents some of the electronic human resource management systems.

Selvi et al. [17], realized an HRMS by Investigation/Growth Core on behalf of Iron/Steel in lieu of predicting the managerial requests, frequent intensive care besides people regulation. This is in order for up keeping the decreasing workers consuming, systematization commercial purposes for People plus Organization section. Adding to that for providing more rapidly staff amenities with accessible contact
to different staff data. There are 5 segments encompassed from the applied system: Staff Personality Profile, Considered Affirmation, departing from Managing, depart from Encashment, and Excursion Managing segment. Implementations of various segments existed for consumers depending on allocated jobs/capabilities. This system had been positioned through the Tomcat Apache Server.

Ying et al. [18], have considered and applied fresh great-outcome, malleable, foldaway EHRMS agenda by means of J2EE stage knowhow. There were 7 segments included within a projected structure (People, Organization, Post, Emolument, Exercise, Performance Assessment, and System Task) Managing. This system fixes many applicable difficulties facing ES for improving HRM effectiveness. It is known by simplicity, relaxed implementation besides owning robust characteristics: relaxed upkeep, relaxed long-drawn-out, suppleness, and safety.

Ouyang and Lu [19], have adopted Computer Supported Cooperative Work (CSCW) in the human resources management information system of the institution of higher education to increase the efficiency of using information and enhance the cooperation. The proposed system solves the existed shortages in traditional HRMS such as lack of sharing and exchanging data and good use of data. The CSCW technology provides a high sharing of data among human resources management information systems and other information systems on different operation platforms. It can provide a community activity support to HRM under the computer situation. Thus, it promotes the HRM of higher education to a new standard.

Abdullah et al. [20], presented a cloud-based HRM system for Small and Medium Enterprises (SME) to solve the problem of separated locations of enterprises. The authors focused on the advantages and disadvantages of adopting cloud-based HRMS within SMEs. The study explored that adopting such emerged technology improves HRM, increases HRM flexibility because the data is stored centrally, allows enterprises to expand, provides easy decision-making, and thus enhances the effectiveness of individuals and organizations. The study explored that the most important advantage of adopting cloud-based HRMS is reduced cost. In contrast, the great barrier is security.

3. Methodology and Modules of the Proposed EEUHRMS

The proposed EEUHRMS has been designed to provide significant services. The structure of the system is formulated according to the Al-Kitab University structure. It consists of fourteen modules with four types of admins: Enterprise Admin, Manager Admin, Financial Admin, and Management Admin. Enterprise Admin authorizes all units’ admins. In addition, all nodules of the system are authorized under the Enterprise Admin. The Manager Admin has the authority of just his department. The Financial Admin has the full authorization of the financial module while Management Admin has the full authorization of the Administrative Affairs Unit. The modules are designed to satisfy the requirements of employees. Modules are used friendly via add, view, edit, delete, and print. The designed modules of EEUHRMS are: Online Recruitment Module (OR), Staff Registration Module (SR), Enterprise Archive Module (EAM), Acknowledgments & Punishments Module (A&S), Leaves Module, Posts Module, Salary Module, Annual Premiums Module (AP), Leave Deduction Module (LD), Dispatches Module, Extra Fees Module (EF), Staff Service Summary (3S), Statistic Module, and Authentication module. Figure 1 shows the proposed EEUHRMS’ modules connections structure.
The new staff of the university should be registered to the proposed system and the Enterprise Admin will assign a role to each newly registered user according to his authority. After that, the user can log in to the system. The user will be directed to the portal according to the user role, for instance, the staff role will be directed to the staff portal. The manager role (Unit Admin) will be directed to the management portal. The financial Admin/employee role will be directed to the financial portal; the management Admin/employee role will be directed to the management portal and the Enterprise Admin role will be directed to the Enterprise Admin portal.

3.1. Architecture of the proposed EEUHRMS
The architecture of EEUHRMS is DOWN-UP architecture. Figure 2 demonstrates the overall architecture of this system. It consists of three main layers:

1. **Presentation Layer:** This layer is a front-end layer where the user accesses the web application at the client-side using web browsers (Firefox, Internet Explorer, Google Chrome, Opera, etc.). It makes the user capable of communicating and interacting with the logic layer to request the human resource components. Bootstrap is a front-end web development framework, which merges functions of (CSS and HTML) with amazing additional effects. This layer involves these tools:
   - HTML
   - CSS
   - JavaScript (includes: Ajax and jQuery).
   - Bootstrap

2. **Logic Layer:** The Logic layer is a server-side layer programmed with PHP language. It represents an intermediate layer between the presentation and data layers. It communicates with the upper layer (Presentation Layer) via HTML forms and JavaScript queries. It also retrieves data from the data layer.

3. **Data Layer:** It is a lower layer in a layered architecture. In this layer, all the coming data are saved into a MySQL database.
3.2. Mechanism of the proposed EEUHRMS
The mechanism of using supported tools to design EEUHRMS consists of four steps:

- **Webpage Design:** It means designing the structure of a web page (i.e. tables, forms, input fields, text areas, etc.) using the HTML tool.
- **Webpage Effects:** webpage effects represent the style of HTML elements (i.e. colours, hovers, font size, positioning, animation, etc.) using CSS tool, Jquery, and Bootstrap classes.
- **Processing:** In this step, all entered data are validated and the necessary calculations are provided to produce the wanted results using PHP, jQuery, and JavaScript tools.
- **Saving and Retrieving:** saving means storing entered data into the database while retrieving is the opposite of saving where data are restored from the database using PHP and SQL tools.

3.3. System Requirements of the proposed EEUHRMS
In order to design and implement EEUHRMS, some requirements are required such as functional and non-functional requirements, hardware and software requirements.

3.3.1. Functional Requirements
A functional requirement deals with what a system is assumed to perform and the services that are appealed. Besides, it specifies the authorization of inserting the data into the database system. Also, prepares the outputs such as reports, and identifies the classifications of data that are inserted into the system. The functional requirements for our proposed system are Enterprise Administrator, Manager (Unit Admin), Staff, and Applicants.

- **Enterprise’s Administrator:** is the person who has the authority to manage the entire system and has access to all modules. He is capable of inserting and viewing details, editing and deleting data, and giving the authority to other newly registered users.
- **Manager (Unit Admin):** each unit or directorate usually has more than one employee. Each unit has one person who represents the admin of the module that is used for his unit of the institution he is working at. These units may be one of the (presidency or colleges).
Furthermore, the admin has the authorization to insert, view details, edit and delete data related to his unit.

- **Staff:** each registered staff has the authority to access and view his personal information, salary, leaves, posts, summary service, acknowledgments/punishments, and archives. However, he has no authority to edit or delete the data.

- **Applicants** are persons who want to apply for jobs. They only can insert data (i.e. personal information and formal documents) and do not have the authority to change them after submitting them.

### 3.3.2. Non-functional Requirements

Non-functional requirements refer to the following requirements features which related to the proposed system:

- **Security:** Information system protection versus illegal entrance or alteration of data is the most significant attribute in each electronic system. The security is important for both the client and server sides.

- **Usability:** The system must provide a friendly user interface and it is easy to learn and use the components of the system via avoiding the complex design.

- **Reliability:** refers to the system feasibility to offer the required duty during a specific period without breakdown.

- **Accessibility:** The registered users have the right of accessing or reaching the system inside the enterprise within the limits of his/her authentication.

- **Extensibility:** The system should have the facility to admit the vital enlargement of its abilities without modifying the basic design.

- **Availability:** The strength of the system to fulfil its assigned role, whenever demanded.

### 3.3.3. Software requirements

In order to design a powerful electronic system with diverse attributes, it is crucial to use necessary software tools such as laravel framework.

### 3.3.4. Hardware Requirements

Hardware and software requirements complete each other. Therefore, hardware requirements are needed to build the system in both Server-side and Client-side:

- **Server-side:** It is the computer that contains the web application as well as the database, which considered two-Tier Architecture (2TA).

- **Client-side:** The client-side consists of two types: Internal Clients and External Clients.

- **Internal Clients:** clients (within university) will be connected to the server with an internal network through a wireless router.

- **External Clients:** there will be (M hosts) to be considered as Applicants that want to get jobs at the university.

- **Internal Network:** The network device that is used to connect the server with clients’ devices is a wireless router. The server is connected directly to the router. The clients are connected to the router wirelessly.

In addition to the above hardware requirements, the proposed system requires other peripheral devices for each unit such as input devices.
4. Implementation and Evaluation of the proposed EEUHRMS

The Graphical User Interface (GUI) of the EEUHRMS homepage before login is shown in figure 3. It consists of an Online Recruitment module and three other buttons (Login, About, and Contacts).

![The homepage of the proposed system (before login).](image)

The proposed system consists of five portals according to the user’s role in EEUHRMS (Management, Finance, Manager, Staff, and Enterprise Admin Portal) as shown in figures (4, 5, 6, 7, and 8) respectively. The user will be directed to the portal according to the user role, for instance, the staff role will be directed to the staff portal. The manager role (Unit Admin) will be directed to the management portal.

The financial Admin/employee role will be directed to the financial portal; the Management Admin/employee role will be directed to the management portal and the Enterprise Admin role will be directed to the Enterprise Admin portal. The administrative affairs unit in the university’s presidency has a significant role in the university because it is responsible for managing administrative issues related to all university staff. Therefore, the Management portal is implemented. It includes ten components, which are Applicants, Staff Registration, Archive, Posts, Leaves, Dispatches, Acknowledgments and Punishments, Service Summary, Salary, and Statistic.

Since the financial unit is an important and accurate unit, therefore, this portal is implemented to provide the financial unit with services related to financial issues via some components that are Staff Salary, Check Premium, Leave Deduction, Dispatches, Extra Fees, Reports, and Report Details. In addition, other components are related to these units of employees like Staff Registration, Archive, Posts, Leaves, Acknowledgments and Punishments, Service Summary, and Statistics.

The Manager portal is allocated for Managers (Head of Department, Dean, Unit Manager except for financial unit and Administrative Unit Manager). This portal involves ten components: Staff Registration, Archive, Posts, Leaves, Dispatches, Extra Fees, Acknowledgments and Punishments, Service Summary, Salary, and Statistic component. All these components are related to the managers of departments/units in order to show all staff information about their departments/units except the Salary component which shows the salary of the manager only. The manager has permission to add, create, edit, and delete staff, dispatch, and extra fees of his/her department/unit.

The staff portal is allocated for Staff and it involves nine components: Staff Information, Archive, Posts, Leaves, Dispatches, Extra Fees, Acknowledgments and Punishments, Service Summary, and Salary component. All these components are related to the logged-in user only. The staff has permission only to read these components’ information.

This portal is allocated for the Enterprise Admin. It involves all components, namely: Applicants, Staff Information, Archive, Posts, Leaves, Dispatches, Extra Fees, Acknowledgments and Punishments,
Service Summary, Salary, Statistic, Add Workplace, and Users component. The Enterprise Admin has the authority to add, view, edit, and delete all components.

Figure 4. Management portal.

Figure 5. Financial portal.

Figure 6. Manager portal.
5. Evaluation of the Proposed EEUHRMS

The evaluation process is a significant issue to assess the proposed system. The EEUHRMS practical implementation is implemented at Al- Kitab University. The System Usability Scale (SUS) is a simple and reliable tool used to measure the usability of the system. SUS is a questionnaire form that consists of ten questions about the system where the even-questions are negatively worded and the odd-questions are positively worded. These ten questions illustrate the level of satisfaction or dissatisfaction of the users. EHRMA, UA, and Staff have applied the proposed EEUHRMS. The testing period was (36 days) from (1/8/2019) to (5/9/2019).

After testing EEUHRMS, the system has been evaluated. The effectiveness, efficiency, and satisfaction of the system’s user perspective have been evaluated to check the usability of the system.

After finalizing the SUS questionnaire, the acquired SUS scores of the proposed system user’s samples have been processed as follows:

- For odd-numbered items, one subtracted from the user response.
- For even-numbered items, the user responses subtracted from 5.
• The converted responses add up for each user and multiplied that total by 2.5.
The obtained SUS scores of EEUHRMS user’s samples are shown below in Table 1.
The proposed EEUHRMS is tested and evaluated by (27) users and the result of the participants' survey is shown in Figure 9. It is obvious from the chart that positive questions attained high scores, while the negative ones produced low values. The results have provided a better perception of the system usability test and evaluation. Also, represents the user’s beliefs on usability issues of the system.

According to the survey results of the proposed EEUHRMS, the highest satisfaction is observed from the questionnaire (i.e. 27 users). It is clear from the results in Table 1 that the minimum SUS score is (50) and the maximum score is (92.5). However, according to the mean of SUS scores, it can be concluded that the provided system is generally perceived to be acceptable depending on the SUS total score, which is (85).

**Table 1.** SUS scores by EEUHRMS participants (N=27).
6. Conclusions

Regarding implementing planned EEUHRMS, it can be concluded that well-organized EEUHRMS depended, planned, and applied. The planned system is able to simplify handling monetary/managerial activities for every private or public university, then renovate apparatuses depended on university staff into automated style. Accordingly, we can say that the proposed system is considered as grounds for connecting university institutions (including one presidency and nine colleges) into a single automated organization. EEUHRMS improves linking amongst the management and monetary branches/units, besides linking amongst the presidency and the colleges. Adding to that, providing the improvement of linking amongst staff and branches/units in full suppleness. EEUHRMS is considered for saving money, wasted time, and exertion. Hence, dependent EEUHRMS maybe depended recurrently for other ESs in Iraq and re-organized depending on these new ESs requirements.

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