



## TECHNICAL ARTICLE

# Design and Implementation a Novel Research Management System

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## ABSTRACT

Publications and researches are one of the important activities of higher education institutions (HEIs) worldwide. Many HEIs, especially in Iraq, are facing different types of problems in managing publication information. This paper presents the design and implementation of researches management system (RMS) to be adopted in one of the state universities in Iraq. RMS is a web-based application to manage the publications and researches information in HEIs. The main goals of this application are collecting all submission publication information in a central database, generating different types of publication reports, generating real-time different statistics, saving all researchers information in the HEI, and facilitating checking and tracking the submitted researches.

**Keywords:** Component, database, management information system, web application

## INTRODUCTION

The researches management system (RMS) is aimed to manage researches information in higher education institutions (HEIs) to improve the efficiency and effectiveness of the research information management processes. Scientific researches and publications are crucial activity for HEIs. The increase in the number of publications, with many types and quantities, has caused many problems in the management, storage, and organization of this information.<sup>[1]</sup>

Another important issue is waiting. This problem occurs because a lot of time is required to deliver this publication information to the scientific affairs department, as the data are still manually recording and stored in many files (paper based).<sup>[2]</sup>

Furthermore, lack of software availability results in a lot of daily work activity in scientific researches departments, as the clerks must collect publication information, statistics of publications, and reporting by hand (manually).<sup>[3]</sup>

At present, the development of computer system and internet technologies has helped humans to do their work as best as possible.<sup>[4]</sup> One of these computer systems is management information systems (MISs), which is an application used to help and support the human to do his activities such as in a private or public sector institution.<sup>[5]</sup>

The management and monitoring of publications in HEIs are an extensive and complex undertaking. There are many problems in the current paper-based system. These problems include collecting information from the colleges, organizing the classification of publications, generating publication reports, compiling publication statistics such as local, international,

indexed, and no indexed, and displaying all details for each publication such as author names, publisher name, date of publishing, and link for research. The last problem is that there is no database for all researchers' information. All these issues take a lot of time to do by hand.

RMS is a web application that is easy to use and work with the different size of screens. RMS was developed using various web technologies such as PHP, HTML5, CSS3, and Bootstrap. PHP is used to implement the server-side of the system. HTML5, CSS3, and Bootstrap are used to develop the graphical user interface. The widespread uses of database technologies have become an important part of information management systems.<sup>[6]</sup>

RMS used MySQL server as a back-end database because it is free, open source, has strong functions, high speed, access to data by multiple users in real time and handling big size of data.<sup>[7]</sup>

## SYSTEM ARCHITECTURE

The general structure of RMS is shown in Figure 1. There are three types of users (system admin, college admin, and

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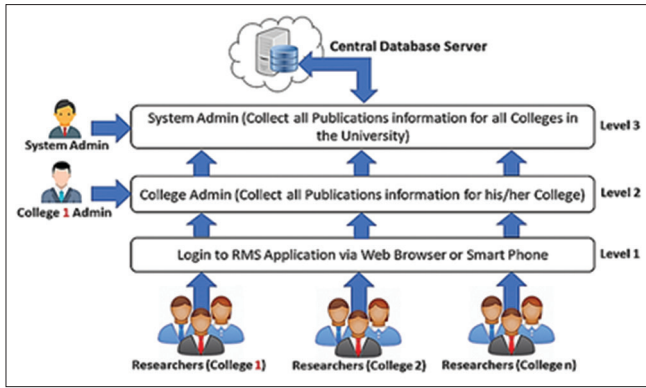


Figure 1: Structure of researches management system

researchers). All users can access the system through any web browser or smartphone. There are three levels of management authentication in RMS and each authentication has own specific roles.

The first level is for researchers to submit all their publication information to the scientific affairs in the college (college admin).

The second level is for college administrators. Each college has an administration person to check all publication information that is submitted by his/her college researchers. After checking this information to ensure that everything is correct, the publication is approved. When he/she has approved this information, it will be available for the third level (system admin) or scientific affairs department in the university.

The third level is for system admin, and he/she can see all college information separately along with real-time statistics for each college and the entire university.

Figure 2 shows the use case diagram for RMS which illustrates the interaction between users and system functionalities.

As depicted in Figure 2, the system admin possesses full authentication such as employee management and can generate any kind of report, see all publication information, and change the user roles in the system. College admin has full authentication only inside his/her college. He/she can see all his/her college information such as college reports, college publication information, and college publication statistics and can add/edit/delete the researcher's information and accounts in the system. The last one is the researcher; he/she can submit his/her publication information to his/her college and see his/her personal publication statistics.

RMS database mainly includes the tables of publication\_info, employees\_information, departments, colleges, and jobs. The database schema for RMS is shown in Figure 3.

### IMPLEMENTATION OF RMS

RMS is accessible from any smart device with any web browser to allow the staff and researchers to use the system. RMS consists of different modules: Researchers management module, publications management module, and reports. Each module is related to one authentication.

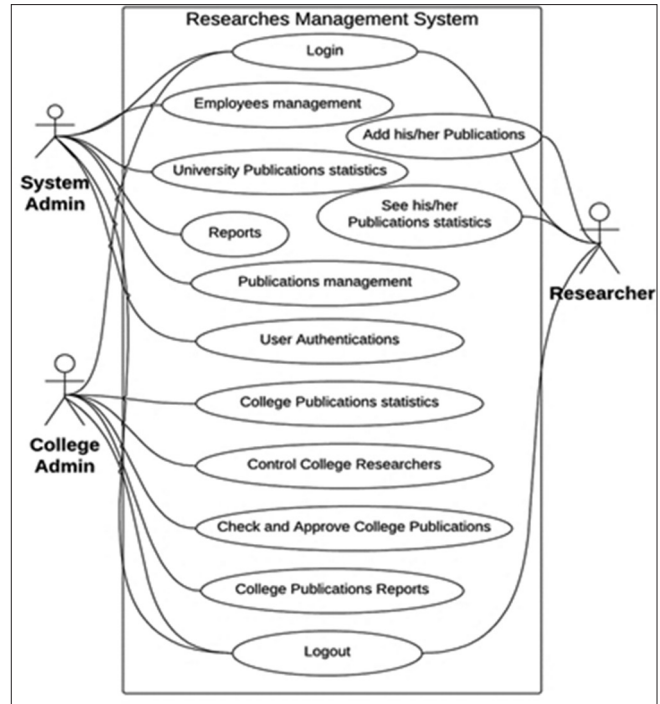


Figure 2: Use case diagrams for researches management system

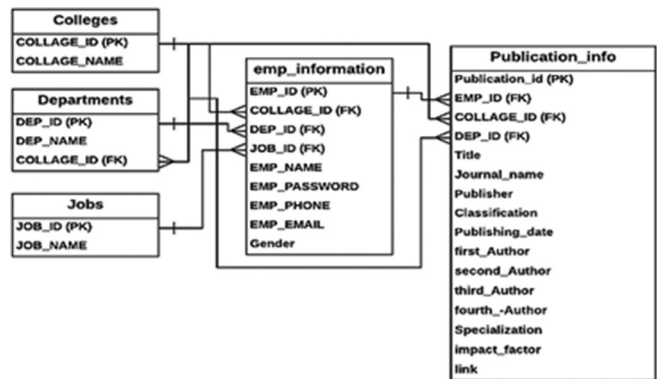


Figure 3: Database schema for researches management system

The researchers management module is provided to the administration system staff for adding, updating, deleting, and viewing all researchers information.

Publications management module deals with all functionalities that are related to the management of researches such as adding new article information, viewing article information, editing article information, or deleting article information.

Reports module is responsible for generating many different types of reports. This module is accessible only for administration staff as they are the ones responsible for reporting on research activities.

RMS is a multi-authentication system. It means that there are many different roles/authentications in the system (system admin, college admin, and researchers). Each user has a username and password to login to the system. If this information is correct, then the system checks his/her role (system admin,

college admin, or researcher) and opens the home page as shown in Figure 4. The details of this page are different from one user to another depending on his/her role in the system.

The main home page consists of three dynamic parts: General statistics, college details, and main menu.

General statistics is the current total statistic. These statistics differ from one user to another depending on the user role. System admin shows all approved, waiting (checking) papers, total number of researchers, and total number of college admin and system admin in the university. College admin shows the statistics for his/her college. Researcher shows the researcher's own statistics. Figure 4 shows the general statistics part. College details display the detailed statistics of publications depending on publication classification such as local, international, Scopus, Nature, Science, Clarivate, SJR, Arabic Journals, and not indexed. Figure 5 shows the college details part of home page.

Main menu is a dynamic menu which displays different submenu depending on the user role. For example, system admin shows all subpages, college admin shows only publications management, college reports, college researchers management, and my profile, while researcher displays only my publications and my profile. Figure 6 shows the main menu part of home page.

My publication submenu includes a list of pages (add new publication, displays all my waiting publications, and displays

all my approved publications). When the researcher submits a new publication, the RMS sends a request to his/her college admin as a waiting publication to check this information. The college admin receives this request and starts to check this information. After checking, he/she can approve this information and will display this information for the system admin as an approved publication. In this case, the researcher

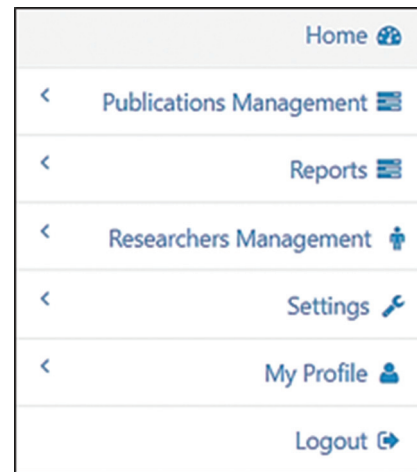


Figure 6: Main menu part

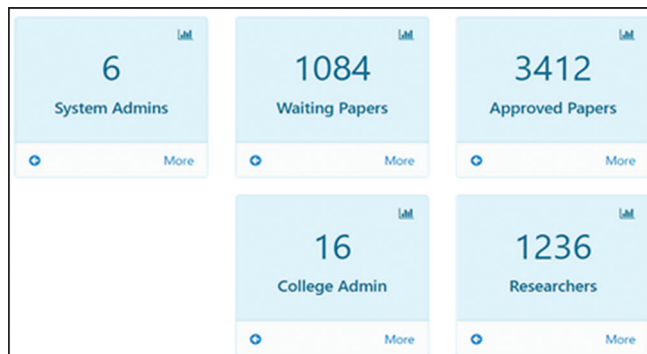


Figure 4: General statistics part



Figure 5: College details part

<input type="text"/>	Publication Title *
<input type="text"/>	First Author *
<input type="text"/>	Second Author
<input type="text"/>	Third Author
<input type="text"/>	Fourth Author
<input type="text"/>	Specialization
▼ قسم علوم الحياة	Department
<input type="text"/>	Journal *
<input type="text"/>	Publisher
▼ Select Classification	Classification *
<input type="text"/>	IF
<input type="text" value="https://ieeexplore.ieee.org/document/8095199"/>	Link *
<input type="text" value="mm/dd/yyyy"/>	Publishing Date *
<input type="button" value="Submit"/>	

Figure 7: Add new publication page

Figure 8: Custom report page

Role	Email	Phone	College	Gender	Name
تدريسي	sdeek_ash@yahoo.com	77072326541	كلية التربية الاساسية	ذكر	أم صادق اشرف
تدريسي	yasser1973@gmail.com	7713552233	كلية التربية الاساسية	ذكر	مريم ياسر علي
تدريسي	Ali@gmail.com	07702222222	كلية التربية الاساسية	ذكر	علي محمد علي
تدريسي	zaiad@yahoo.com	07723333333	كلية التربية الاساسية	ذكر	أمجد زياد محمد
تدريسي	Banali1990@gmail.com	077288563214	كلية التربية الاساسية	انثى	مريم بان حاسم

Figure 9: Researchers information page

cannot update this publication information. Figure 7 shows how to add new publication information.

Another important submenu is reports, which include a list of pages such as waiting report to display all waiting publications for college or all university depending on the user role, approved report to display all approved publications. The last and most important one is a custom report, which is a page used to generate different kinds of publication reports, for example, publication within two different dates or specific classification such as only Scopus, IEEE, local, international or Clarivate, college, department and so on. The results can be downloaded as an Excel sheet. Figure 8 shows how to generate custom report.

Researchers management submenu is including a list of pages such as add new researcher, display all researchers, edit researcher information, change researcher role, and display all researchers information. Figure 9 shows how to display all researchers information.

Setting submenu also includes a list of pages (add new college and add new department). This submenu is only

for system admin to do the system configuration. The last submenu is my profile. In this page, the user can edit personal information such as name, email, password, and phone.

## CONCLUSIONS

RMS was successfully developed and implemented as a web-based application for scientific affairs department. This system was used and tested by one of the Iraqi governmental universities. This testing was done by real users for usability and it showed an acceptable performance and ease of use in solving real problems of publication information management at the university. RMS is used to improve efficiency and effectiveness of scientific affairs in the university. Furthermore, it is used to reduce the time and effort to create publication reports and reduce the time to check the publication information. Moreover, RMS is an electronic archiving for all researchers information in the university. RMS connects all colleges in real time with the scientific affairs department.

The evaluation of scientific affairs department for RMS was positive. It is easy to use, offers high accuracy statistics, makes it easy to search for any information about the publications, and is faster than paper process and suitable for managing publication and researches information at HEIs.

Finally, the RMS has achieved all objectives and fulfilled its purpose to develop a novel web-based application to collect and manage all publication information. This could be a low cost, high-efficiency solution, with high accuracy, and faster for managing publication information in HEIs.

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