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Original Research Article

Electronic Document Management System for Kırıkkale University

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Today, universities and institutions produce and use a large number of documents in several types. Producing, sharing, copying and archiving documents are an important issue. Most of the institutions and universities handle these tasks manually or semi-automated. However, it is faced with many problems in practice since there is not an effective document management system. It is difficult to achieve necessary documents quickly when it is required and to share these documents with others when it is needed. For such reasons, institutions have to develop document management system applications. In this study, a document management system developed for the Kırıkkale University is discussed.

Keywords: Electronic Document Management System, Document

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INTRODUCTION

Documents are the most important source of knowledge and experience for the institutions. In the 21st century, which is called information age, institutions archive the materials and documents to compete with each other. Institutions want to access these information and documents in the archives in an easy way to learning from past experience and planning a better future. Accessing the requested document among the thousands of documents in archive from anywhere and at any time is important for efficiency. Today, document management systems are developed to access the documents effectively and to ensure the management of documents.

What is the Document Management System?

"Field of document management responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records, including processes for capturing and maintaining evidence of and information about business activities and transactions in the form of records ". (ISO 15489-1:2001).

Documents were prepared by using papers in the absence of widespread computer systems. Documents were removed to the archives after a certain period of use. In fact, human beings began archiving documents dating back 5,000 years (Keskin ,2007). The idea of document management was proposed a lot before personal computers came into our lives. It was discussed since the beginning of the 19thcentury, to enhance the competitiveness and the activities of the institutions, but it became a discipline when it came to 1934(Özdemirci ,2008).

Electronic Document Management System (EDMS) can be described as a system which starts with preparing documents in computers or uploading prepared documents to computers; continues with saving the document header information (document name, document editors, document type, document date, subject, abstract, page number etc..), making changes on the document and sharing the document with different users; ending with archiving the document and based on the principle of managing all of the stages.(Hüseyin,2009).

The reasons such as high cost of creating physical archives, the mess caused by copying and replicating the documents, high cost of photocopying and fax, high cost of managing and archiving documents in physical environment necessitated to manage documents in electronic environment. Electronic management systems provide various advantages to institutions. By using these systems, while costs are declined, accessing to documents is shortened, work efficiency is raised, multiple people are enabled to work on the same document and connection can be established easily between different documents.

The rest of the paper is organized as follows. In Section 2, we discuss the related work in document management. Section 3 describes our electronic document management system developed for Kırıkkale University. Finally in Section 4, conclusions and possible future work are discussed.

Related Work

Several studies have been carried out for more efficient document management systems in the universities of Turkey and World.

Özdemirci (2008), who has various studies on document management system, examined document management systems that are used in several countries in the World. At the same time, he initiated the launch of the document management system project by examining the shortcomings and problems of universities in Turkey. Also, he prepared the "Document Management and Archive System Guide for Universities" with the team he has established.

Beside the universities in Turkey, the government institutions are also started to use electronic document management systems rapidly. The document management system in Turkey is fulfilled within the framework of T.C Prime Ministry Circular No. 2008/16 with the date July 15, 2008. Önaçan et al. (2012), examined the work of legislation and laws in operation by making a literature survey. They expressed in their study that all institutions and universities in Turkey will have to move to the Electronic Document Management System soon to keep up with technological development.

Ermiş (2006) stated in his study that with the advent of information technologies, a lot of important official documents and materials are sent through the internet. He mentioned about the details of electronic signature that is used to provide safety, integrity and to ensure the sending/receiving action cannot be denied. He also discussed the impact of electronic signature technology on the document management systems.

Volarevic et al. (2000) compared the document management systems with printed papers. The advantages and disadvantages of both systems are listed as a table. They stated that signature is the most important problem in the document management systems and this problem is solved by using biometric signature. Also, they discussed the overall architecture of EDMS and how organizations can integrate the EDMS to their systems.

Although the majority of universities all over the world use of computer based system, they don't give up using

paper according to Syed et al. (2009). They mentioned that universities maintain their document management using a semi-automated system or paper today.

Generally, document management systems are designed by using a database. However, Yao et al. (2003) worked on a document management system according to ISO 9000 standards by using the XML structure of the new browser-based language.

Hernad and Gaya (2013) mentioned how a document management system can be integrated according to "ISO 9001:2008 Quality management systems" standards. Six steps of this standard were discussed.

1. Defining the document requirements,
2. Evaluating the existing systems,
3. Determining the document management strategy,
4. Document management system design,
5. Implementing the document management system
6. Maintaining the document management system

Kao and Liu (2013) discussed that organizations produce a large number of documents in several types and there is a real challenge in managing and effectively using of produced documents. Two main targets of document management systems were mentioned in their work. First target is accessing a document at anytime, anywhere and on any machine; second target is sharing a document with other users and enable them to make changes on document content at the same time.

Ensuring the safety of the system is one of the most important issues today. Richard et al. (1999) stated that the database is the most important component of an electronic document management system so the security of the database is crucial for the system security. The biggest difference between TEDMS and EDMS is the MLS database used by TEDMS systems.

EDMS System for Kırıkkale University: KKU-EDYS

Work which will be examined here is an Electronic Document Management System program developed to be used in Kırıkkale University. Generally EDMS programs are programmed using object oriented and n-tier architecture as Volarevic et al. (2000) mentioned in their work. N-tier architecture is the most widely used form of architecture today.

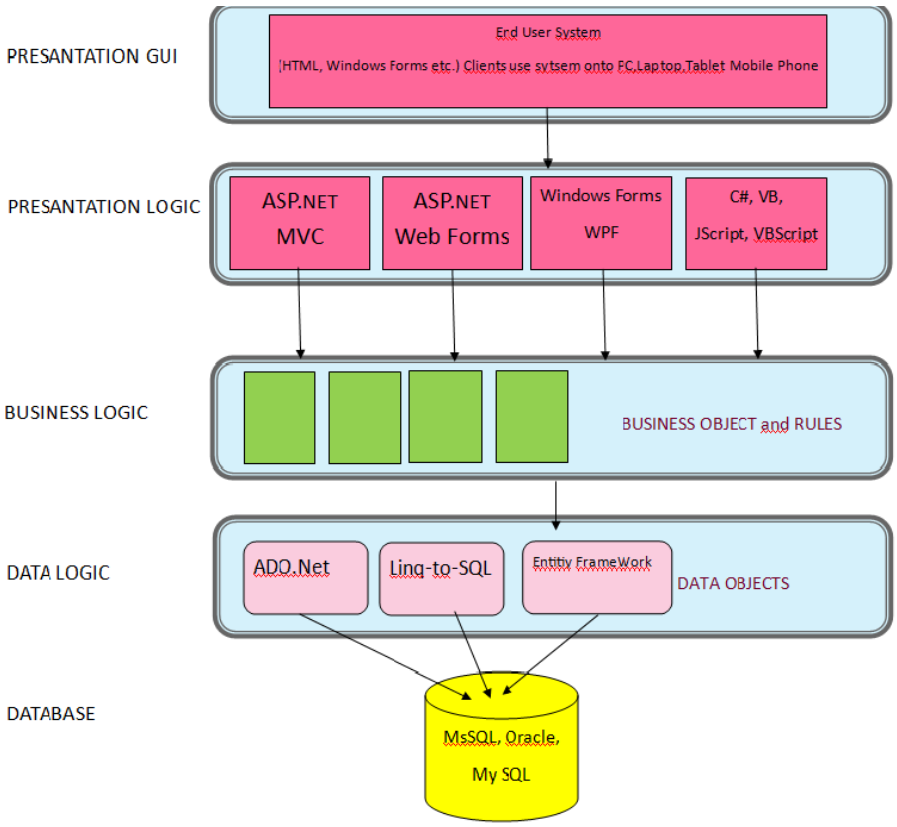

Figure 1. N-Tier Architecture

N- Tier Architecture is preferred because of the reasons such as easy project management, well suited to teamwork and effective fault management.

The developed program consists of Data, Data Logic, Business Logic, Presentation Logic and Presentation GUI layers which are shown in Figure 1.

Database and server are at the Data Layer which is the bottom layer. System database design is used in Microsoft SQL Server 2012. There are codes that provide connection between the program database on the Data Access Layer. Entity Framework[2]is used in this layer and all kinds of DML (SELECT, UPDATE, INSERT), DDL (CREATE, ALTER, DROP) and SQL (SELECT) queries are written in this layer. Presentation Logic layer is the layer in which web pages which the user sees are designed. The system is designed using JavaScript, ASP.net and C# program language.

Entity Framework (EF) *is an object-relational mapper that enables .NET developers to work with relational data using domain-specific objects. It eliminates the need for most of the data-access code that developers usually need to write. (http://www.asp.net/entity-framework)*

Presentation GUI, the top layer of N-Tier Architecture, is a web interface that provides access to the end user. It is not possible to make unauthorized entry to the designed system. User privileges should be specified when a person is registered to the system. Otherwise, it is not possible a person to use the system. Registration of a person to the system is realized by authorized personnel. After a user entered to the system, the pages which he could see are varied according to his privileges. Unauthorized standard users are enabled to realize following procedures in the system;

- Creating, deleting, updating and searching document
- Downloading and uploading document
- Printing document
- Sharing and sending document
- Creating, deleting, moving folder; updating folder name
- Messaging and chatting
- Updating profile
- Keeping statistical information
- Changing password

The authorized users are enabled to realize following tasks in addition to these transactions;

- Adding user, deleting user, authorizing user and assigning a user to a group
- Adding parametric information to the system such as group, department authorization type
- Viewing logs, getting reports

After a user entered to the system, main page which is shown in Figure 2 is displayed. A folder tree showing the documents of the user is displayed in the left part of the main page. When a folder is selected from the folder tree, the documents under that folder are displayed in the middle part. In the right part of the main page a messaging system between online users is displayed.

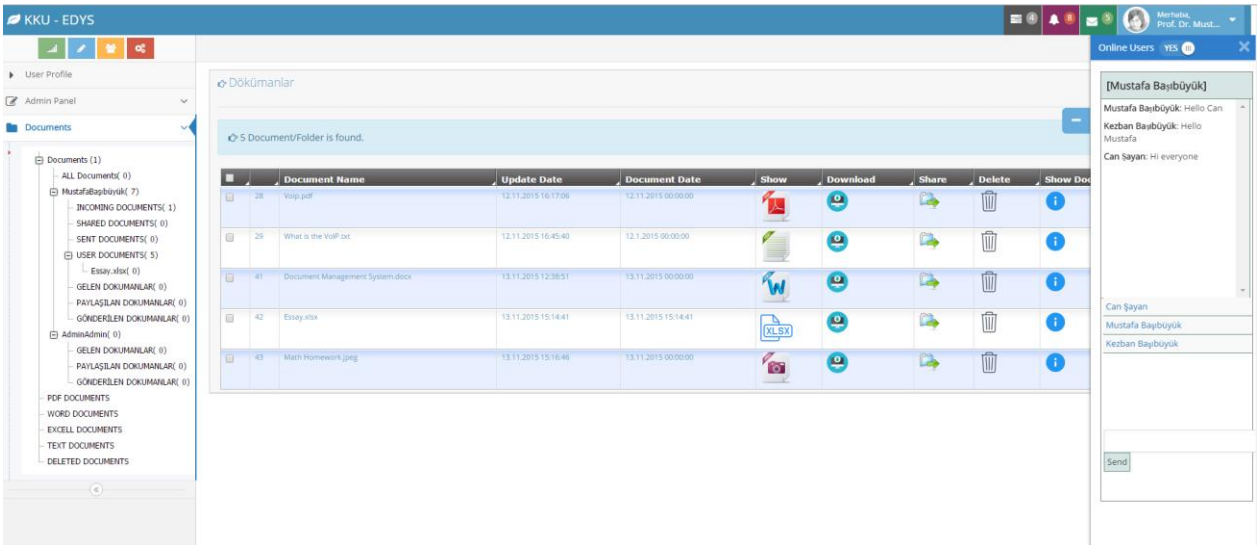

Figure 2. Main page of the KKU-EDYS

Documents are opened in the web browser editor as shown in Figure 3 and web editor allows documents to be modified. To add a document to the system, user opens the "document adding page" and enters the required top header information. After this, the document content can be entered in two ways. In the first method, user can upload document that is prepared before in the mobile phone, tablet, pc etc... In the second method, user prepares document on the web editor and saves it to the system. Only one person is allowed to update a document at any time. When a user opens the document, the document is locked for this user. So, when other users want to open the document, the system gives warning "You cannot access to this document, because another user is editing this document". When user closes a document, closes the browser or logs out from the system, the lock on the document is released automatically and the document is opened other users use.

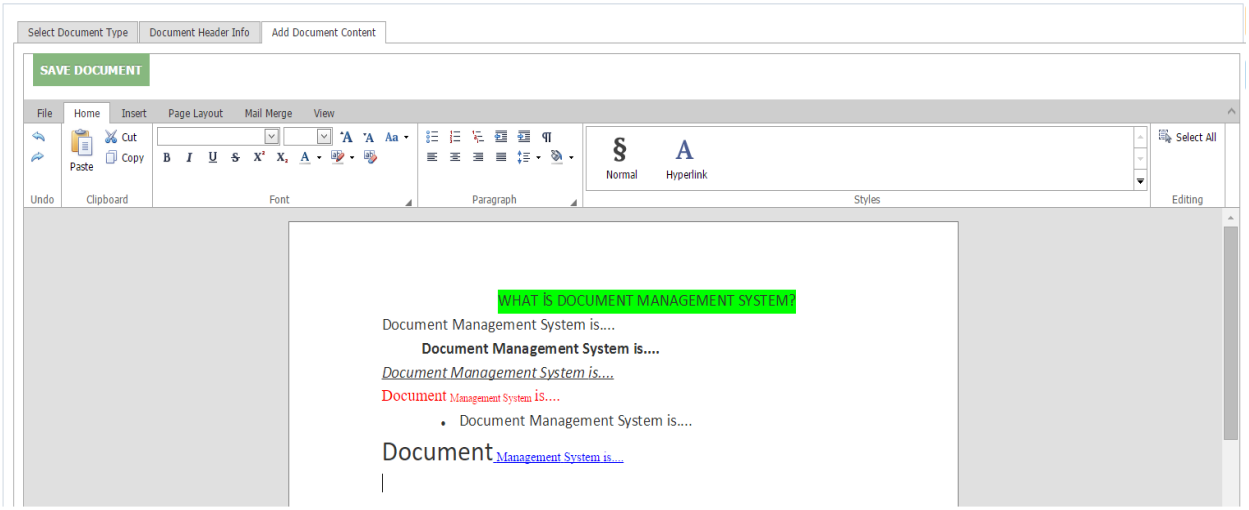

Figure 3 Web Editor

Documents are composed of two parts. The first part is document header information which is document name, document type, number of pages and date of document; the second part is the document content. Both parts are kept in different tables in the database. There is one-to-many relationship between two tables. Namely; more than one content can be related to a document. The main aim of this structure is providing a version control system and getting previous versions when required. Since document contents are kept in binary format, all kinds of documents such as Word, Excel, PowerPoint, xml, text documents, information and other files such as audio file, video file and program files can be loaded into the system.

The content of Word, Excel, xml and text documents can be modified. Although documents are kept in database, users see documents in the folder structure as they have created. There are two types of folder in this system. The first type is system folders that are created automatically by the program when users are registered to the system, and the second type is user folders that are created by users as shown in Figure 4.

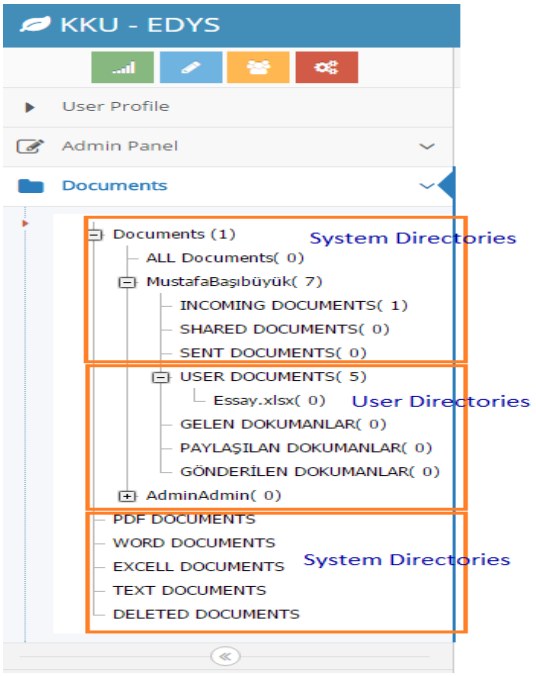

Figure 4 FolderStructure

A user can change the name of a folder that he created before, move the folders/documents or delete the folders. When user deletes a folder, all of documents in this folder are deleted. Deleted documents can be recovered thus the system protects the documents from users mistakes. It is not possible to do any update action on the system folders that are defined as common by the programme for all users. System folders cannot be deleted and cannot be renamed. Also, any folders cannot be added to system folders. System folders are created according to the document types (pdf, word, excel text) as shown at the bottom part of Figure 4. When one of these system folders is selected, the documents of the user are listed according to document types.

Once a document is uploaded to the system, it can be shared with any other person easily. There are two different methods for document sharing. First method is using the document with requested people as common. In this method, the shared document can be updated by the shared persons. Second method is sending a copy of the document. In the second method, the sent person owns a copy of the document. Sharing and sending documents can be done individually or collectively. In universities, academicians and other staff generally work in at least one department. When people are registered to the system, their departments are also saved. When a person sends/shares a document to a department, this document is automatically sent to all people in that department. The second batch posting process is the process of sending documents to a group. Groups are created by the administrator such as professors, associate professors, experts, etc. A person can be assigned to a group during registration or afterwards. Groups can be considered as a kind of occupation or title. A person can be assigned to any number of groups. There is no limit on the number of person's groups. A professor can be head of the department while he is also an academician. There is no drawback of assigning a person to more than one group.

The system allows documents to be downloaded. Users can download a document to computer, update this document, print this document and upload back to the system if necessary. When uploading the document, he can upload as a new document or update the existing document.

To increase the communication between users, a messaging system is integrated to the system. Users can send private messages to anyone or they can send message to all online users if they want. Messaging system is integrated into the system, using the SignalR[3] which is developed by Microsoft. When a user is online, other users are notified immediately by the system. Online users in the system are displayed to other online users.

All program transactions are logged by the system. The information such as which document is changed, who changed the document, when the document is changed, what changed in the document is saved. In case that a document is not changed, but it is opened, the information about this is also saved. In the version control system, changed document, changing user, changes, date and time of change are kept. Furthermore, not only the last change, but changes in different times are kept. Old versions of documents can be used when necessary. There is a flexibility at this point to prevent the mess that would occur in document changes. In addition, statistical information about users, departments, groups and documents are saved to the system.

[3] ***SignalR[3]*** *It is written to develop a framework for real-time applications.*

CONCLUSION

Today using document management systems has become inevitable. Users want to perform all their work independent of space and time. Cloud computing, emerged in recent years, which means that serving more people by using less hardware resources, is rapidly reaching into every aspect of our lives. With the help of document management systems, although a generated document is placed as only one copy in the database, dozens or even hundreds of people can access to the document, update the document, send the document, print and download the document since it is shared between users. In other words, more than one user can access to a document. Two main targets mentioned in Kao and Liu (2013)'s work has been carried out in the EDMS system developed for Kırıkkale University. Hence a service similar to cloud computing was presented.

The developed EDMS system is currently in the testing phase and it is considered to open to users as soon as possible.

The access to the system is possible seven days, twenty four hours through EDMS's web-based infrastructure. It is possible to access to the system from inside-outside of the university using any mobile device which has internet access such as PC, laptop, tablet. In this way, approval and monitoring of in-house important documents and forms is provided and business continuity is achieved anywhere in the world.

Currently, there is no access to the document at the same time. In the future studies, the system can be developed to be accessed simultaneously like Google Docs. In addition, the reliability of the documents can be provided by adding digital signature.

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