A Prototype Design for Digital Right Management of Digital Library in E-Education : A UML Based Approach

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Abstract

Digital Library is the essential component of e-education system , which is based on digitized data. The security of digital data is very much essential. In this paper we proposed a well structured prototype model of Digital Right Management (DRM) for Digital Library. Here we use UML, an efficient Object Oriented Software engineering tools, to represent different component of this system.

Keywords: Digital Library, E-education, DRM, UML

1.   Introduction

Information and communication technology has changed the way of access to information and the concept of Digital Library or e-Library has come up. It is essential for libraries to store information electronically. Digital library has given birth to e-Education. Digital library can be seen from different perspectives[1,10,11,12] each having its own emphasis, like Computer Science as enabling technologies, Library Science as library services, Management as day-to-day administration, etc.

In Digital Library there are digital data for books, journals, etc for the use of students, researchers, teachers, etc. To protect digital data we use the technology called Digital Right Management(DRM). DRM is collection of several technologies that are used for protection of Digital Work [7]. It is clear that if we have digital data we have to protect that data by DRM tecniques.

Protection of Digital Library is an important issue[3,7]. DRM tools like Acrobat Reader, Microsoft Reader, Watermarking, etc. DRM manages rights regarding copy right laws for protecting digital content [7]. DRM is used to protect digital data from unauthorised users, don't allow multiple copy and print , giving permission to access certain area of the system .

Fig 1 shows the interaction among E-education system,, Digital Library , DRM techniques and different users of the system. Digitally protected contents should not be accessed by any unauthorized user, even authorized users are not able to supply his or her material to any non registered user as well as registered user can also use the contents for limited time period only.

Different state of digital data[2] as shown in Fig 2 describe when the data are created by course designer the data has to be digitized and several DRM techniques are used to protect the data and protected data are preserved in digital library from where user can use digital content from time to time modification is needed.
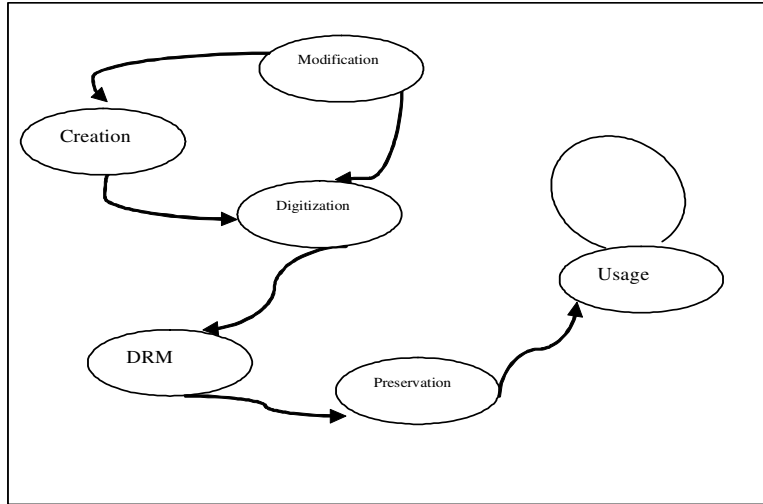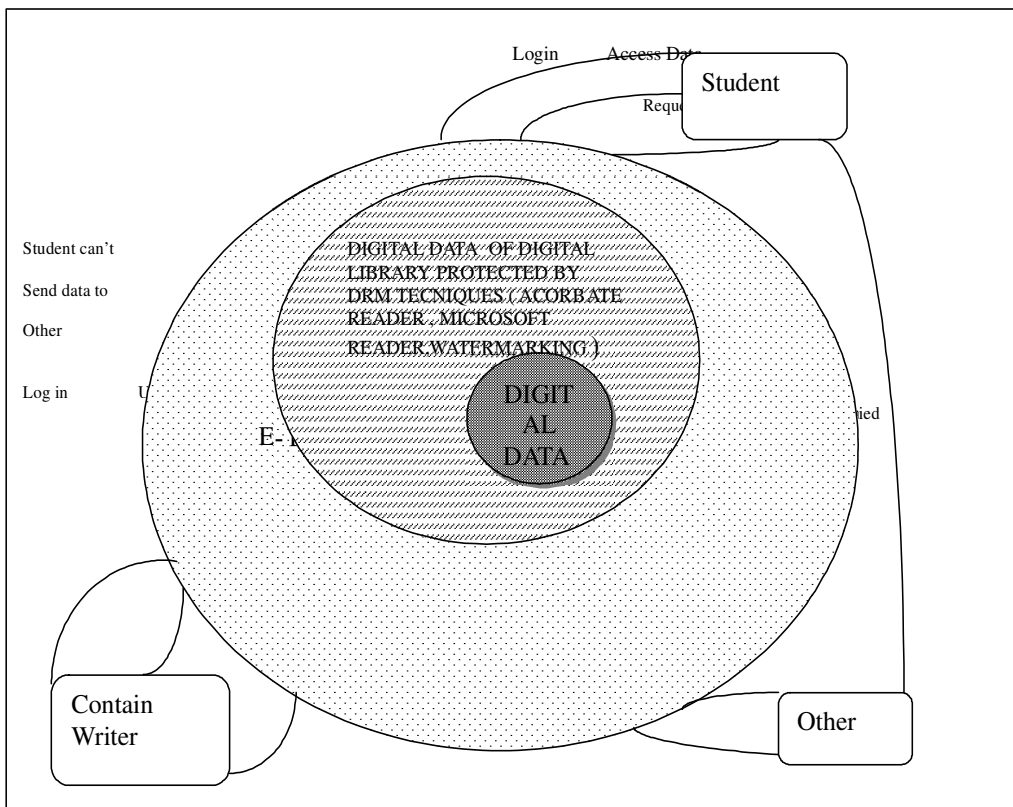
Figure 2: State of Digital Data

Figure 1 :DRM protected Digital Library in E-Education System

2.   DRM tools and Techniques[7]

There are some tools and techniques by which we can protect digital data, may be included as components of DRM. Some of them are given below:

2.1 Encryption: Encryption is a technique to protect digital work. In this techniques we encrypt the file using a key and only the key holders are able to decrypt the file . In this way we protect data from unauthorised user but not fully because key holders have the authority to disclose the key to other users. If key linked with BIOS or hardware of the authorized user then the security level will be increased.

2.2 Adobe Acrobat: Adobe Acrobat has the facility to protect digital work from copying and pasting. In Adobe Acrobat we define security methods such that the protected files are not copied as well as not printed.

2.3 Microsoft Reader: Microsoft reader may be used to read e-book. It provides protection of digital data from tampering by highlighting the name of owner, protection from copying and pasting.

2.4 Watermarking: Watermarking is a group of methods and technologies that can protect digital data. Watermarking may be used for copyright protection of Digital data .By watermarking techniques we can protect our files, images, audio, video, etc. Watermarking may also be used in authentication, certification ,   photo development laboratory ,OCR software etc. Some watermarking tools available are WMT Plus, visual water mark.

3.   Methodology

A set of Object Oriented software engineering tools, UML, is used for design purpose of the proposed system.

3.1   Identification of Object: The objects that are essential for the system are as follows:

Student: The user of the system and ultimate beneficiary by the system.

Teacher : Mediator between the system and student and play important   role for the success of the system.

Digital Data: Digitization[3] is the process by which we convert data to digital data and by applying DRM techniques protecting digital data .

Course Designer: Course Designer is a person or a group of persons , entrusted to develop course materials submitted to content writer.

Content Writer: Basically content writers are translator s. They translate course designers' manuscript to digital data.

Library Manager: A person or a group of persons responsible for over all management of digital library.

3.2   Use Cases

The use cases for our proposed system are given below. Here each use case denotes one subsystem.

3.2.1   Use Case 1: Student

The use Case related to student object activity with system is shown in Figure 2.

♦   Registration: Student intended to use Digital Library is registered first.

♦   Login: Registration system provide an user id and password to the student that they use when login into the system.

♦   Validate Student[2]: This use case check the authentication of user.

♦   Assignment : Student must have to submit their assignment on time.

♦   Search: Digital Library   has hues data like e-journal ,e-book, e-material etc., user search the digital contain according to their need.

♦   Access DRM Protected Data: Only validate user can access DRM protected data.

♦   Query: Students send their query to teachers.

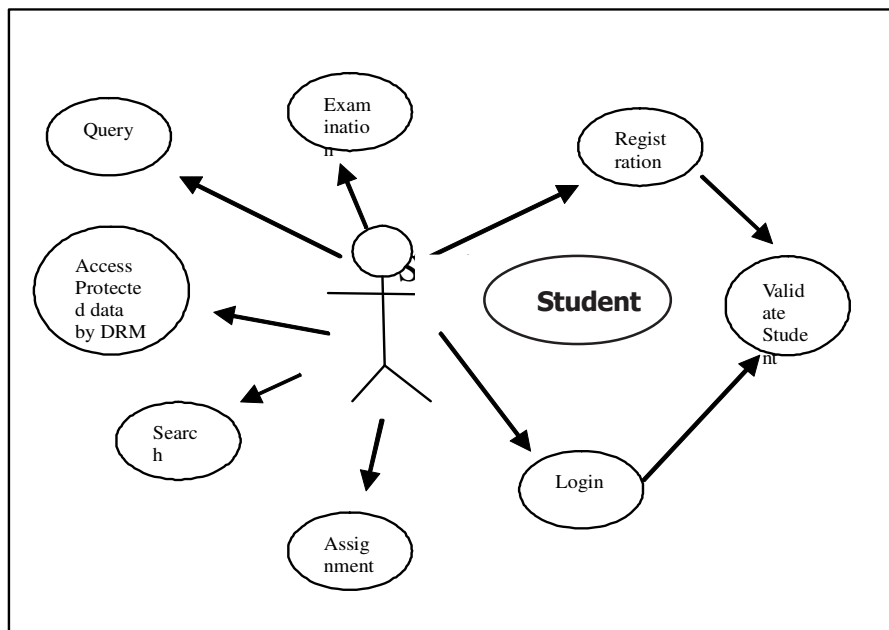♦   Examination: The evaluation of student is measured by examination.

Figure 3: Use Case 1

3.2.2 Use Case 2: Teacher

Figure describes six use cases of teachers

♦ Online Lecture: Teacher deliver online lecture to the student of e-education system.

♦ Solve Query: Teacher system answer the query submitted by student.

♦ Consult Course Designer : Teacher give their valuable suggestion for system advancement to the course designer.

♦ DRM: Course Designer consider the suggestions regarding DRM techniques.

♦ Check Assignment: Teacher check student assignment.

♦ Report: After checking the assignment teacher send a report to the system for student performance.
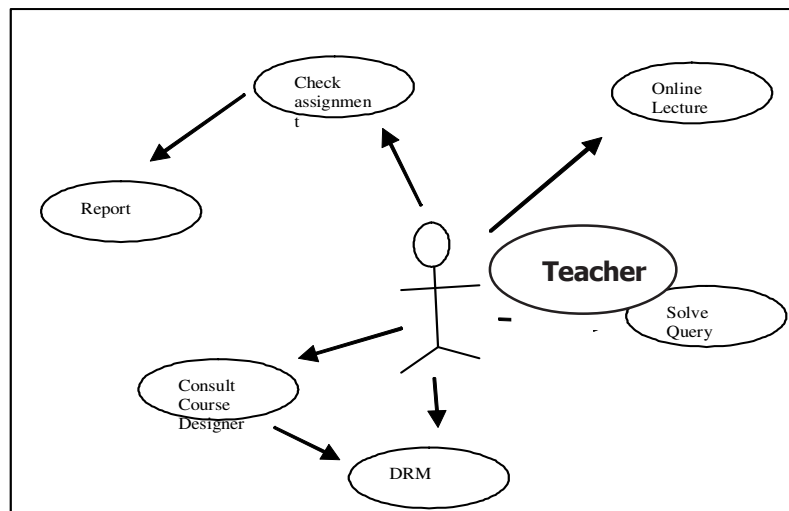
Figure 4: Use Case 2

3.2.3. Use Case 3: Course Designer [13]

Course designer's interaction with the system are shown by the following four use cases.

♦ Suggestion Collection: The suggestion of different users like students, teachers, content writes are consider by Course Designer for designing the course.

♦ Manuscript & DRM: After consider the suggestions course designer prepare manuscript that contain

♦ Model Question : Model Questions for students are prepare by course designer.

♦ Update Design: Periodically design of the system is updated.
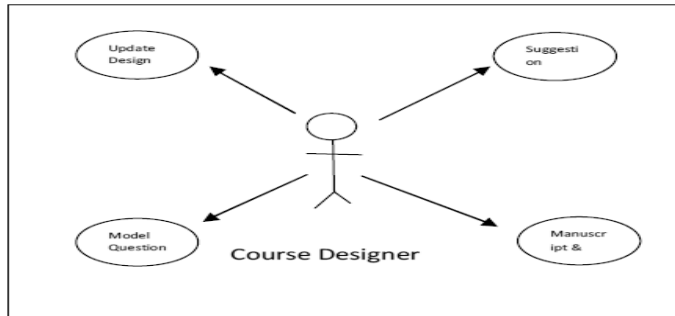
3.2.4 Use Case 4. C

Figure 5: Use Case 3

3.2.4 Use Case 4. Content Writer[13]

Figure shows the interaction of content writer with the system.

♦ Registration: Before writing digital content into the system contain writers are registered first.

♦ Login : Content Writer login into the system with the privilege of modifying the content of digital library.

♦ Validate Content Writer: This use case check the authentication of content writer.

♦ Digitization: Content writer digitize the manuscript given by course designer and upload into the system.

♦ Consult Course   Designer: content writer consult course designer for their doubts.

♦ DRM Techniques: Several DRM techniques are use by content writer to protect digital data.
♦ Update Content: Content   Writer update the content according to course designer manuscript.
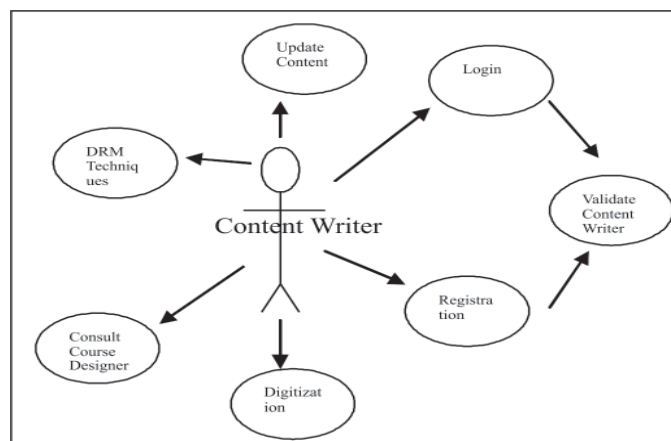

Figure 6: Use Case 4

3.2.5   Use Case 5. Library Manager

Figure 7 describes interaction of Library manager with the system along with six use case.

♦   Fee Collection: Any type of fee like membership fee , id card fee etc. are collected by library manager.

♦   Check DRM Security[2]: DRM techniques are tested by library manager.

♦   Monitor System: Whole digital library system is monitor by library manager.

♦   Communicate student: Student interaction is also done by library manager.

♦   Conduct Examination: Examination is conducted to test the evolution of student.

♦   Publication of Result: The evaluation of student is published in the form of result.
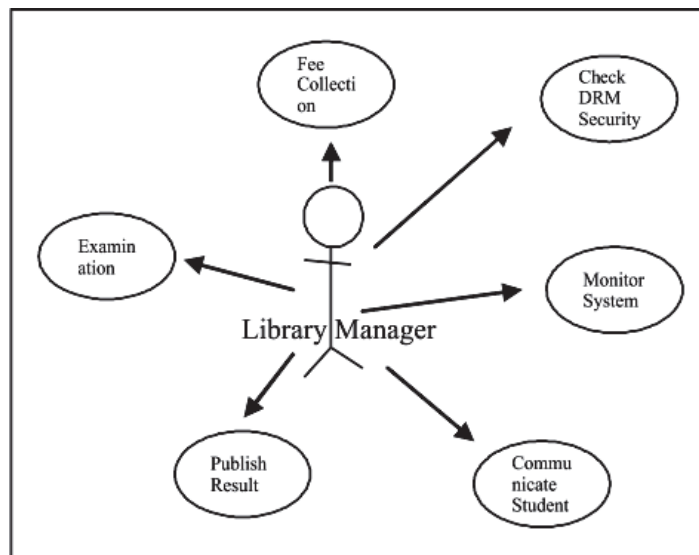
Figure 7: Use Case 5

3.3   Sequence Diagram

The sequence diagram describes communication of data between different objects of the system.

3.3.1: Digital Data Protection and Use Figure 8 describe how the primary user (student) use the protected digital content by DRM. Student first Log in into the system, search the digital content that are digitize and protected by content writer using different DRM Techniques and use the data.
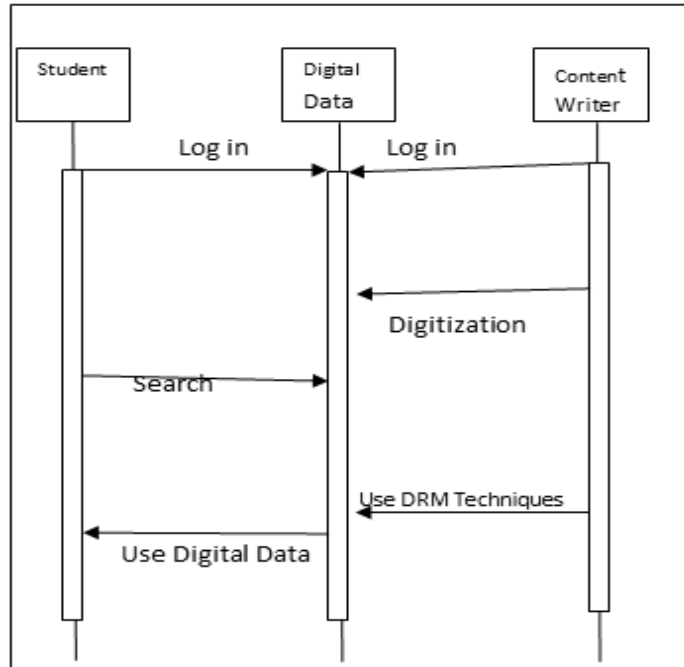
Figure 8: Digital Data protection and Use Sequence Diagram

3.3.2   Student Teacher Sequence Diagram: Student Teacher sequence diagram as in Fig 9 describe how the student , teacher communication takes place. Teacher gives video lecture to his student and answers their questions. Teacher provides assignment to student that are submitted by student.
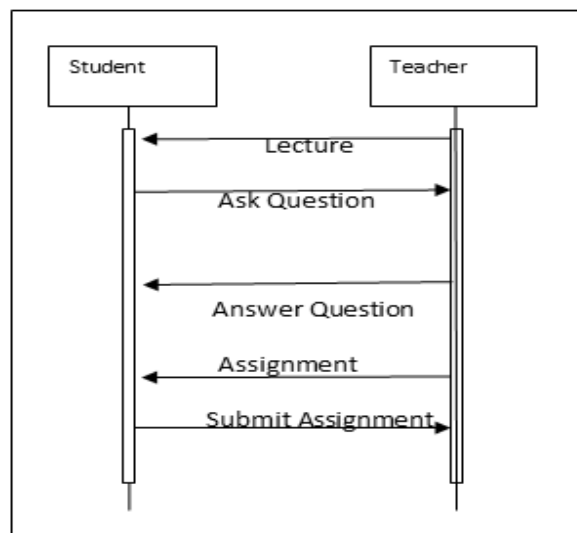

Figure 9: Student Teacher Sequence Diagram

3.3.3 Course Modifier Sequence Diagram : Fig 10 shows how Course Designer and Content writer interact into the system . Course Designer submit Course manuscript to Content writer for Digitization and applying DRM techniques. Content Writer ask query to course designer regarding manuscript and give suggestion to course designer for modification.
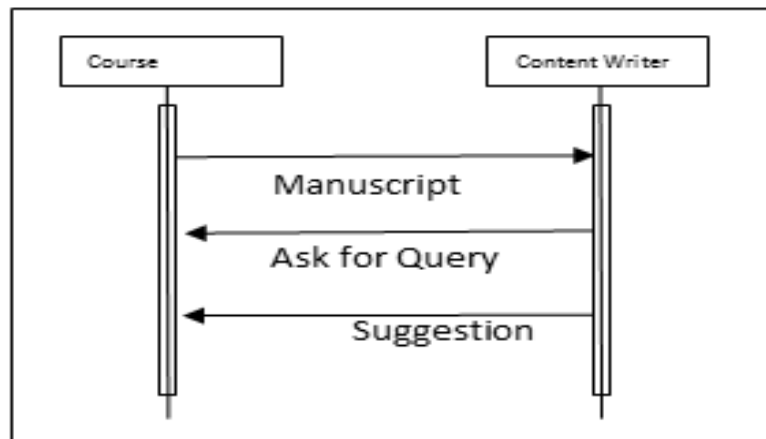
Figure 10: Course Modifier Sequence Diagram

4.   Conclusion

Digital Library is the basis of e-education. There are a number of challenges facing to protect digital data. There are so many copy right laws to protect data but the laws are not up to the mark in this case we solve the problem with the help of technology. In this paper we proposed a conceptual model of Digital Library.

Our prototype model's key concept is DRM technology that protect digital content from unauthorized user and different DRM techniques that are used to protected Digital data and a UML based design of different object of the system and their interaction.

References

1. Borgman C., "What are digital Libraries? Competing visions", Information processing and Management, 35, 1999, 227-243.

2. Banerjee S., Booth D. E. , Ghosh S. , Mukhopadhyay S. , " A Prototype Design for Digital Intellectual Property Right Management in E- Commerce – A UML Based Approach",Journal of the CSI , Vol 36 , No 4, 2006 ,12-17.

3. Singh A. K.,Mukhopadhyay S., Karforma S, Ghosh A., "Object Oriented Design of e-Library for e-Education " ,International Conference on Computing and Systems (pp 163-167) 19-20 November 2010.

4. Iannella R. ,"Digital Right Management (DRM) Architecture " , D-Lib Magazine , June 2001.

5. Banerjee S. , Karforma S," A Prototype Design for DRM based Credit Card Transaction in E-Commerce", ACM Ubiquity, Vol. 9, Issue 18, May 6 – 12, 2008.

6. Erickson J. S., "A Digital Object Approch to Interoperable Rights Management "D-Lib Magazine , June 2001.

7. Coyle K., "The Technology of Rights: Digital Rights Management", Based on a talk originally given at the Library of Congress , November 19, 2003.

8. Coyle K. , " The "Rights" in Digital Rights Management ",D-Lib Magazine , September 2004.

9. Jonker W, Linnartz J. P. ,"Digital Right Management in Consumer Electronics Products" , IEEE Signal Processing Magazine , March 2004.

10. Nicholson S. "Management of Digital Library: New techniques for new technology",1995, www.bibliomining.com/nicholson/newvl.html, (accessed on 15.11.2010).

11. Saracevic T. and Dalbello M. , "Digital library research and digital library practice: How do they inform each other?" 2003, www.scils.rutgers.edu/~tefko/articles.htm , (accessed on 15.11.2010).

12. Biswas S. C., "Digital library services: Management techniques in the aid of librarian",15, 2008, 07-16.

13. Singh A. K. , Mukhopadhyay S. , "E- Learning in Distance Education Using UML ",International Journal of Information and Computer Science (IJICS), Vol 12 , Number 2 , (pp 30-35), December 2009.

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