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Interactive E-Lecture Using Video Annotation in Learning Groups

Atul S. Choudhary *, Prof. Balkrushna K.Patil **
**(Computer Science and Engineering, E.E.S., Dr. Seema Quadri College of Engineering & Tech., Aurangabad, India.)*
*** (Computer Science and Engineering, E.E.S., Dr. Seema Quadri College of Engineering & Tech., Aurangabad, India.)*

ABSTRACT
Now day's users are interested in distance learning as there is rapid growth in digital data due to day today development in information as well as computer technology. Also its applications or usage have tremendous response in market. Peoples are attracted towards interactivity in each thing, we found that for e-learning is a very interactive way to learn and understand things. Currently, YouTube is the global way of video sharing. It is having certain limitations such as, it having inactivity in online learning. In online study students expecting some extra guidelines from given resources. In this project we developed video annotation system for foster active learning. In this project, we achieved active participation of students. There is certain kind of technologies that extracts some important keywords from textual information. MOOC's model is another technology to solve interaction problem of users in active learning. It also has limitations that it suffered from the problem of gamification. Our system is interactive as it provides real-time annotations to the video. In our system user can give their active participation as they have direct interaction to our system. As part of our contribution in this project we did SVM analysis to provide recommended videos for end users. SVM is Support Vector Machine algorithm; it classifies the things according to user interest. So, in our system user can search for video and they get recommended video list for their study.

Keywords: Feature extraction, Video Annotation, Retrieval, E- Learning, Workplace Training, Tagging and Classification

I. INTRODUCTION

According to survey of distance learning in educational development. In 2011, U.S country students are applying for at least one online course in semester[1]. For distance learning there is virtual envirnoment is created as there is physical distance between students and lecturer in distance learning. As everyone know that, today YouTube act as a central hub for sharing online video. But it is invaluable tool for professional learning. For professional learning there is need of such tool that make learning session interactive, informative and make people engaged. In short, a tool that has capability of transferring boring as well as difficult lectures into an interactive and exciting learning experience. One approach is known as tele-teaching approach. It is collaborative video annotation stratergy in digital world. It required to collect culturer participations to improve active learning[2]. We developed a system called as video annotation system. It supports interactive learning as well as to share large amount of metadata in short time period. Certain technologies like OCR and ASR are used to extract important keywords from textual line given in video. But it seems not much efficient for video annotation. Our system provides real time annotation for running video. In our system user can mark or annotate imporant points from running video. MOOC model is "Massive Open Online Course". It mainly used to solve human interaction problems in virtual scalable laboratories. MOOCS model used in e-learning to support all services of it i.e. interacting with learners in that envirnoment.It is helpful to make students engaged in lectures that are conducted online. In our system, students can create a group as they have their own accounts on social networks. students can have discussion on video lectures.

Our research analyze that there is need of such system that can deal with both individual and group annotations. Also there is need of such manuscript that allows students to have some searchable notes with a timestamp that enables them to jump into the video at the desired points for revision. Also the learning effectiveness when watching e-lectures showed a tendency to be higher when students used the manuscript function in addition to watching the video.

The main focus of our research is to present identification of digital video annotation that provides added benefits and to make

recommendations as to which features improve learning and experiences with video annotations. This is necessary, because up to now the user perspective on lecture video annotation has not been taken into account in much of the previous research and development projects. First of all, the evaluation aims at showing that digital video annotation improves learning effectiveness when using lecture videos. Second, individual annotations are compared with annotations from learning groups. Third, several principles from the culture of participation are employed and evaluated to make a statement about their usefulness. Wikis are very popular tools for digital video annotation. The academic search engine Yovisto by Sack and Waitelonis for example, is extended by a wiki. Alternatively, they allow collaborative annotation via tagging of lecture segments. Those tools are the means for further discussions about and explanations of the lecture video. They can be used by either students or lecturers [22]. Finally, one further method designed to provide added value to users of the annotations the enhancement of keywords within the annotation with automatically generated topic maps is evaluated. We have introduced a collaborative video annotation function and illustrated several user studies and questionnaires we conducted to test this function. From the students' feedback, it is obvious that this kind of participative feature is desirable in a distance learning setting. Students favor the manuscript feature that allows them to have searchable notes with a timestamp that enables them to jump into the video at the desired points for revision. Also the learning effectiveness when watching e-lectures showed a tendency to be higher when students used the manuscript function in addition to watching the video. Nevertheless, a further need for modifications to the functions has been revealed. In our system we make number of improvements to the manuscript and marker functions. We also provide user interface with some usability adjustments. We utilized the automatic segmentation function as well as to assign the annotations to the time span of the matching segment.

We developed a kind of system in which lecturer is responsible to upload lectures video. While uploading video lecturer also he/she perform some other task such as, they specify time period for displaying uploaded video. Lecturer is wholly responsible for handling or managing video sessions that are to be display on specified time period. For highlighting main topics in lectures they can add some important keywords, tags etc. so that student will get idea about that particular topic from lecture video. Our system provides related links as well as outside resources for simplifications of searching of video lectures from large set of video lectures. Furthermore, if student wish to study any lecture that already existed, in this case, our system provides facility of rescheduling for required lecture in specific time span. Lecturer is responsible for rescheduling particular lecture. Other than lecturer or admin-side we also developed a panel for students. In this panel student can watch and save different parts of uploaded videos on specified time by lecturer. At the duration of watching videos, our system provides facility to highlight or annotate specific point from playing video and save it. If students mark or annotate some points during any lecture next time whenever they watch that particular video they will get their annotate point that they previously marked at specific time while again watching that video. Students also have a facility to create of people and they can share their ideas, metadata related to video lectures etc. with their group mates. So, that can have a proper discussion on particular topic and they can solve others queries as well as they may get suggestions for their queries. Our system provides flexible and efficient searching methodology for students. This searching is based on classification of various elements of our system such as, keywords, annotations, links, resources, video title, and time etc. For such kind of classification our system utilizes SVM algorithm. SVM is ML i.e. Machine learning Algorithm. It is used for classification. With this algorithm users or students are able to search videos according to important keywords, annotations, links, resources, title of video or its uploaded time etc. When students wish to search videos depending or specifying such type of parameters then our system recommends videos form large set of videos that are correlated with search parameter. Therefore, our system proves its efficiency in terms of searching. With SVM algorithm it required less time to get search results of videos.

As a part of contribution we are proving recommended video list on users search. Hence, we proved our systems efficiency.

II. RELATED WORK

Y. Haojin, F.Grunewald, Bauer M. et. al [1], discussed about, automatic video indexing and video search in huge lecture video storage. To offer visual guidelines segmentation of video and key frame detection technique is used. In this keyword extraction is used. Video retrieval and video search systems such as Google, YouTube, and Bing etc. reply on available textual metadata like, title, genre, person, and brief description etc. Generally, this kind of metadata has to be created by a human to ensure a high quality. OCR and ASR algorithm are applied to OCR text lines that are adopted in the subsequent keyword extraction process, by which both video-

and segment-level. It captures every knowledge change between adjacent frames as well as it also captures real slide transitions. It requires most complete experience on annotation to enhanced e-learning platforms on all devices, and especially on mobile ones, which have important constraints in terms of display size and general capacity. The proposed a novel concept for content-based video search systems. A user study was conducted to investigate the effectiveness of proposed indexing methods. With this system much more content-based metadata can be generated efficiently. Moreover, the temporal video information can also be adopted for some special retrieval tasks such as lecturer action and gesture recognition. To retrieve content-based information high level text semantic is used.

F. Grune , C. Meine[2], suggested involvement of multiple user in e-learning platform. During their discussion, they suggest different improvements to really create a culture of participation in tele-teaching. As an example feature they were use collaborative digital video annotation. This would helps to tackle the problem of user participation in video retrieval as well as video search system. For implementation of this system, Tele-Teaching Web Portal is used. Also this system improves Active Engagement by Establishing a Culture of Participation. For positive result it requires more reflecting of culture participations. They suggest different solutions based on collaborative digital video annotation as one possible feature. The most essential findings thereby are that awareness mechanisms have to be created by storing a history of all contributions to a group annotation and allowing access to statistics of all individuals' input. Finally two scenarios are suggested how online discussion and problem solving can be started by the teacher. Especially video annotation supports the generation of large amounts of metadata in a short time span; this functionality is used as sample feature to explain the approach to implement a culture of participation to more actively engage users.

G. Fischer [3], found the motivation to anticipate is intrinsic. It support human interaction problem. Support different capabilities, interest and different knowledge. It is a meta-design, which opens up the infrastructure to enable collaborative design. To identify social abilities, technical skills there is need of people's culture participation. System developments for cultures participation but they are not sufficient. Students are enabled to solve problems by collaboration as it uses various interaction techniques. Culture describes their media tools for thinking, working, learning etc. research explores the theoretical foundations as well as it includes technological changes in human centered computing. In this participations are invited, supported and valued.

F. Grunewald, Meinel C., M. Totschnig et al.[4], describe an analysis of the survey responses with respect to some questions about MOOC accommodate different learning styles and also recommendations for the design and organization of a MOOC. It supports human-problem interaction in scalable virtual laboratories, and learning services and practical tasks that connect with learners' living environment, and create responsibility and engagement. MOOCs share the goal of bringing together thousands of learners into a common event. In this paper provides confirmation about learners acknowledge quality of video lectures as well as textual learning resources. To extend MOOC model, it requires learning human problems, gamification as well as social responsibilities. Massive Open Online Course(MOOC), held in German at openHPI ,that attracted a large audience that has not been in contact with higher education before. In this paper authors were adopting and improving in our current research and development activities: human-problem interaction in scalable virtual laboratories, and learning services and practical tasks that connect with learners' living environment;

R.Rence , T.Nalini[5], demonstrate Linked Data technologies. It is for semantically annotate and search educational video resources. Linked data technologies are used by Annotation and the Sugar Tube. Semantic methods are used for retrieval of data using Linked Data Services (LDS). It links data resources together to enrich to result of original video. It is a very crucial task in which linking, exploring, reusing of these all educational resources. Thus, providing the facilities for annotating these video resources is highly demanded.

A. Y.S. Su, Stephen J.H. Yang et al.[6], investigates about how a Personalized Annotation Management System 2.0 (PAMS 2.0) helped students annotate documents and share their own annotations in collaborative learning context. Technology known as, PAMS 2.0 used for students coordinates and negotiate with others. By designing this type of annotation management system personalized management, sharing, and reusing individual and collaborative annotations are shared annotations among multiple users. To provide experienced instructors a personalized annotation management system 2.0 (PAMS 2.0) is developed. PAMS 2.0 guide students coordinate and neglect users in face to face communication. With this instructors also identify student's behavior of learning. Some factors including the design of this curriculum, learning period, teacher, assigned articles, and more) that could influence the use of instructional tools and learning scenarios. This could be better exploring by doing more research.

Although some possible factors (including the design of this curriculum, learning period, teacher, assigned articles, and more) that could influence the use of instructional tools and learning scenarios have been discussed, no major factors or reasons for this phenomenon can be found in this research. This is worth exploring through further research.

C. Hermann and T. Ottmann[7], contributing themselves to developed tool (aofconvert), that enable students to directly associated lecture recordings in a Wiki at a specific point in time. This tool converts object-based lecture recordings to PDF and other output formats. In this paper, aofconvert tool combines wiki with recorder lectures. This tool enables students to visually direct references in lecture recordings. Therefore there is tight integration between wiki and lecture material that allow students to explore learned topics. With this technology students actively participated in collaborative learning process. This technique also enhanced slide transition detection technique in video based recordings.

P. N. Mendes, M. Jakob, A. García-S2, et al[8], compare their DBpedia Spotlight approach with the state of the art in and evaluate the results in light of three baselines and six publicly available annotation systems, They also demonstrating their competitiveness of their system. DBpedia Spotlight, a tool to detect mentions of DBpedia resources in text. The entity linking keyword from the annotation is linked to an entity in the Linked Data Cloud DBpedia. This link is visualized within the users' annotation to provide him or her with further research possibilities. The NER, disambiguation and entity linking problems have already been solved and published in a service called DBPedia Spotlight. This approach is utilized for implementation of our annotation system. RESTful and SOAP web services for the annotation and disambiguation processes are used for integration of DBpedia. For evaluation of annotations authors are using an unseen dataset. This system retrieves more configured approach than publicly available Services. It requires resources to be complex relationship within knowledge hub.

E. Lesage, M. Valcke, Sabbe[9], aims to present a comprehensive review of multiple choice scoring methods currently used in higher education, for outputting analysis of weaknesses and strengths. According to research in this paper, there is need of reducing the gap between theoretical possibilities and Practice. It is important for test designers to know about these ranked methods with their limitations. For measuring student's knowledge, a multiple choice test is a widely known in higher education. Number right scoring (NR) and negative marking (NM) are most commonly used scoring methods for multiple choice assessments. Problem with both NR and NM system is that they do not meet expectations. This paper aims to review an overview of (alternative) ranked methods for multiple choice tests, in which strengths and weaknesses of each method are provided. This system use the term 'negative marking' to describe scoring method. Studies report an increase in validity or reliability when negative marking is implemented. However, these studies only show slight improvements and they specifically examine true/false/items. This system instructs a student to guess or not is far more difficult to answer than it seems. It is also difficult for students to figure out the optimal decision strategy under negative marking. In this respect, more consistency in scoring methods of multiple choice tests is recommended at program or institutional level in higher education.

A.W.Y. and H.S. Chan[10], studied about multiple fill gap from existed system. In this system they were trying to conduct more assessment tests for multiple choices test methods. With their continuous study they explore signal detection theory. It is required for quantitative analysis of individual's performance from multiple choices. As the multiple-choice test is the task of multiple-choice, liberal multiple-choice, elimination testing, confidence marking, probability testing, and order-of-preference scheme, it does not identifying the best test method for use. In this paper, authors would provide the multiple-choice test methods and tends to facilitate people to conduct effective assessments in various subject areas. In this paper multiple-choice approach used and also reliability of each Multiple-choice method would be determined. Thus, it provides a clearer picture on the common multiple-choice methods and facilitates people to conduct more effective assessments in various subject areas.

C. Hermann [11], discussed about "Rubine algorithm". It is used for feature extraction to classify gestures. Their research shows that omitting the features that are heavily decreases the quality of the recognition. Powerful searches engines are required for the implementation that allow users efficiently to retrieve documents fulfilling their information needs, as increasing use of lecture recordings, providers are facing the challenge to make electronic lecture materials both easily accessible and searchable. It requires a very less search times of only a few milliseconds for searching lectures recordings and retrieving documents. Extended HTML Format allows including the results of the gesture classification and additionally extracted properties into the index. So that data can be reused in searching process and hence it improving the information and visual appearance of the search results. It uses LECTURNITY player for accessing information that is required. For improving the relevance estimation

during the indexing process of lecture recording documents, it requires maximum relevant gesture classes. The introduction of the Extended HTML Format allows including the results of the gesture classification and additionally extracted properties into the index. In this way data can be reused during the search process as well as improving the information and visual appearance of the search results.

R. Mertens, H. Schneider, et al [12], discussed about the differences between hypertext documents and lecture recordings with respect to Hypermedia navigation features along with virt Presenter. It is a prototype software tool for automatic generation of hypermedia user interfaces for lecture recordings. Hypermedia navigation features are used for recordings of lecture and also to develop and a prototype implementation of the concept. For lecture recordings that incorporate all of the navigational features found in current hypertext systems. In this paper authors were deciding to design a learner-interface. This approach has technical and conceptual problems for adopting features statically.

Tele-TASK – Tele teaching Anywhere Solution Kit[13], this paper suggest new tele teaching package "ease to use". It is based on internet. tele-TASK accomplishes all needs of modern tele-teaching. With tele-teaching people could be reached fast. It supports all platforms, various bandwidths, arbitrary programs. Also it does not required install additional software's, their configurations at the users end. This system is firstly developed for recording and transmission in computer science lecture on topic "Information security in open networks" in 2002. It is possible to provide high quality tele-techning without using technical and financial amount.

O. Aubert, Y. Prie et al. [14], shows video-annotations used in e-learning as video have number of rigorous problems. Especially, authors were considering MOOCs (Massive Online Open Courses) from a point of view of didactic processes as well as current challenges. Video annotations are information pieces that can be anchored in the temporality of the video so as to sustain various processes ranging from active reading to rich media editing The project goals are to build and animate a platform for both disseminating and promoting rich media open courseware content, as well to test research ideas related to the use of video annotations and machine learning techniques in e-learning. It is implemented using MOOC's Model. It requires most complete experience on annotation to enhanced e-learning platforms on all devices.

M. Ketterl, O. A. Schulte [15], determines which points are to be recorded. Also it identifies at which position and in which form includes metadata as well as its parameters for distribution. For example campus data is combined by IT departments. For learning management systems and administrative databases Matterhorn is available.

F. Greunewald and C. Meinel[16], introduces a collaborative video annotation function. For testing functions authors depicted several studies and applications. In this paper, according to student's feedback we noticed that Evaluation of Digital E-Lecture Annotation in Learning Groups is more desirable in distance learning. For usability of authors adjust the user interface by improving manuscript and marker functions. The use of video lectures in distance learning involves the two major problems of search ability and active user participation. Finally, evaluations in the form of user tests and questionnaires in a MOOC setting are presented. This system aims to make annotations easily searchable as well as reusable annotations and also student can store their data. In this system for retrieving data from slides OCR technique is used. It works efficiently for copying data into manuscript as well as it allow students to store data outside the portal.

III. PROPOSED SYSTEM

The first paragraph under each heading or subheading should be flush left, and subsequent paragraphs should have a five-space indentation. A colon is inserted before an equation is presented, but there is no punctuation following the equation. All equations are numbered and referred to in the text solely by a number enclosed in a round bracket (i.e., (3) reads as "equation 3"). Ensure that any miscellaneous numbering system you use in your paper cannot be confused with a reference [4] or an equation (3) designat **Steps:**

Admin Side:
- Registration & Login
- Upload Video
- Add Annotation with TimeStamp
- Add relate d Links & Resources
- Manage Sessions
- Update Related Topics
- Reschedule Lectures
- Delete video

User Side:
-View Current session Video
- Explicite Time Based Annotations
- Chat Room
- Search Video

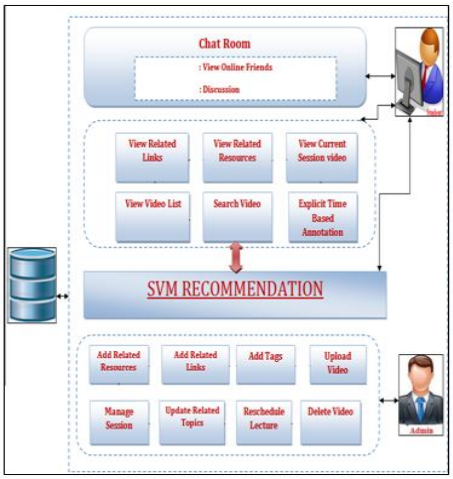


Fig.1: System Architecture

IV. ALGORITHM

-"Support Vector Machine" (SVM) algorithm is mainly used for classification that based on given attribute. In our project we are implementing SVM algorithm to generate recommended video list for end user as per their interest.

In our system user can search videos by giving search input as annotated words, video title, date and time etc.

-Therefore to generate recommended video list SVM will work as following way:

Input: Cluster set 'c'
-Set of videos.
Output: Recommended video list
Processing:
Cluster= {Closest Video w.r.t keywords, title, annotations, related resources etc.}

If
Match is available
Then
Find match
Cluster=Cluster U match
If any $\alpha_p<0$ due to addition of c to S
Then
Cluster = Cluster \p
Repeat till all such points are shorted/ pruned.
End if
End while
Return Recommended video list.

V. MATHEMATICAL MODEL

Sys = {U, Ip, Fn, Op} Where,
U = User of system
I = Input to the system
O = Output from the system
U = {Ad, En} Where,
Ad = Admin of the system
En = End user of the system

Ip = {Ip1, Ip2, Ip3, Ip4, Ip5, Ip6, Ip7, Ip8, Ip9, Ip10} Where,
Ip1 = User registration details
Ip2 = User login details
Ip3 = Admin Login
Ip4 = Video Upload
Ip5 = Video Annotation
Ip6 = Video Related Sources
Ip7 = Video Related Files
Ip8 = Lecture Details
Ip9 = User Personalized Annotation
Ip10 = Search Keywords
Ip11 = Chat Member Selection
Fn= {Fn1, Fn2, Fn3, Fn4, Fn5, Fn6, Fn7, Fn8} Where,
Fn1 = User registration Function
Fn2 = User Login Function
Fn3 = Admin Login Function
Fn4 = Video Upload Function
Fn5 = Add Video Annotation Function
Fn6 = Add Video Resources Function
Fn7 = Add Video related files Function
Fn8 = Configure lecture function
Fn9 = Add Personalize Annotation Function
Fn10 = Search function using SVM algorithm
Fn11 = Chatting Function

Op= {Op1, Op2, Op3, Op4, Op5} Where
Op1 = User Account
Op2 = Admin account
Op3 = Lecture Video
Op4 = Video Related Metadata
Op5 = Lecture Session
Op6 = Chatting Session

Mathematical representation using set diagram:

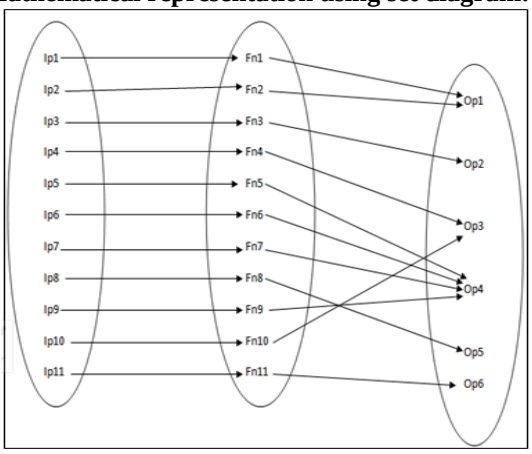
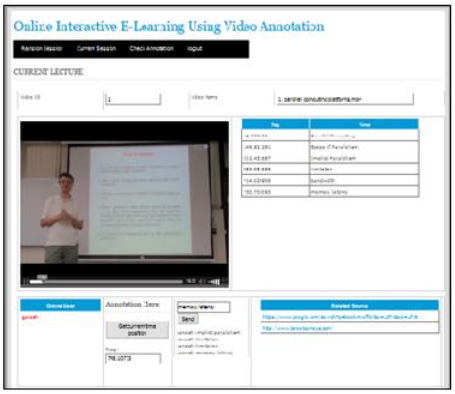


Fig.2: Venn diagram

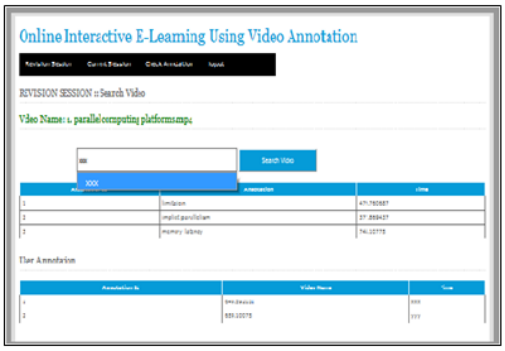
VI. EXPERIMENTAL RESULT

To build our system we have used jdk1.7. mySQL is used to store databse. Eclipse IDE for project development of project and Apache tomcat

5.7 is used at server side for jsp and servlet.For the purpose of testing we have used core-I3 and 4-GB RAM.



-Above screen is designed for annotating important topics from running video.
-This annotation is based on time slice.
-Also annotations are shareable.

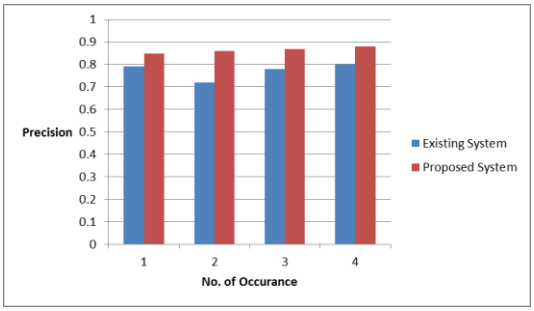


-Above Screen represents list of recommended videos.
-Search function of our system is implemented using SVM algorithm

Comparison between existing and proposed system:

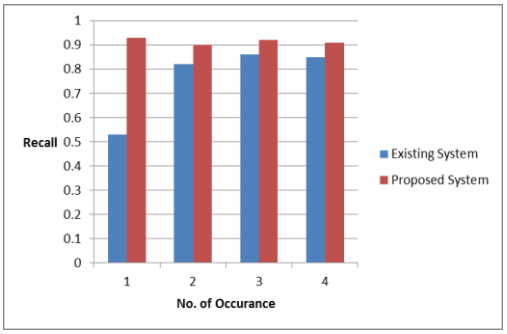
Precision:

Existing	Proposed System
0.79	0.85
0.72	0.86
0.78	0.87
0.8	0.88

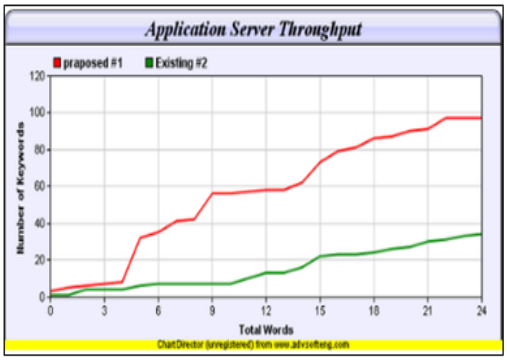


Recall:

Existing System	Proposed System
0.53	0.93
0.82	0.9
0.86	0.92
0.85	0.91



Throughput:



VII. CONCLUSION

In this paper we discussed about our video annotation system which works efficiently with respect to time and searching. We used SVM algorithm for searching. It is based on classification. Therefore, students can search required videos by specifying keywords, annotations, link, related resources etc. Lecturer have facilities in designed control panel having some upload videos, manage sessions, rescheduling of lectures etc. whereas, student can learn lecture by watching online videos. They can annotate imp. Topic from playing video, so that they get reminder of imp Topics while next time they watch that specific video Students can create a group to chat, to discuss about lecture topic, queries that they get, they may share metadata related to video. Etc. With this many facilities our system proves it's efficiency and flexibility compared to other systems. As a part of contribution we are proving recommended video list on users search. Hence, we proved our systems efficiency.

The current research intended to improve the classification of videos by including automatically generated information such as automatic captioning stored in database. In the future, we consider

enlarging the annotation set and integrating more features to construct more representative model for semantic concepts.

REFERENCES

[1]. F. Grunewald, H. Yang, E. Mazandarani, M. Bauer, and C. Meinel, € "Next generation tele-teaching: Latest recording technology, user engagement and automatic metadata retrieval," in Proc. Int. Conf. Human Factors Comput. Informat., 2012, pp. 391–408.

[2]. F. Grunewald and C. Meinel, "Implementing a culture of € participation as means for collaboration in tele-teaching using the example of cooperative video annotation," in DeLFI 2012—Die 10. e-Learning Fachtagung Informatik. Hagen, Germany: Gesellschaft fur Informatik, 2012

[3]. G. Fischer, "Understanding, fostering, and supporting cultures of participation," Interactions, vol. 80, no. 3, pp. 42–53, 2011.

[4]. F. Grunewald, C. Meinel, M. Totschnig, and C. Willems, € "Designing MOOCs for the support of multiple learning styles," in Proc. 8th Eur. Conf. Technol. Enhanced Learn., 2013, pp. 371–382.

[5]. Dr. R.RajaRence , Dr.T.Nalini," Using Linked Data to Annotate and Search Educational Video Resources for Supporting Distance Learning and Research"

[6]. A. Y. Su, S. J. Yang, W.-Y. Hwang, and J. Zhang, "A Web 2.0-based collaborative annotation system for enhancing knowledge sharing in collaborative learning environments," Comput. Educ., vol. 55, no. 2, pp. 752–766, 2010.

[7]. C. Hermann, "Electures-Wiki—Toward engaging students to actively work with lecture recordings," IEEE Trans. Learn. Technol., vol. 4, no. 4, pp. 315–326, Dec. 2011.

[8]. P. N. Mendes, M. Jakob, A. Garcıa-Silva, and C. Bizer, "DBpedia spotlight," in Proc. 7th Int. Conf. Semantic Syst.-I-Semantics, Sep. 2011, pp. 1–8.

[9]. E. Lesage, M. Valcke, and E. Sabbe, "Scoring methods for multiple choice assessment in higher education—Is it still a matter of number right scoring or negative marking?" Stud. Educ. Eval., vol. 39, no. 3, pp. 188–193, 2013.

[10]. Annie W.Y. Ng and Alan H.S. Chan" Different Methods of Multiple-Choice Test: Implications and Design for Further Research"

[11]. C. Hermann, "Techniken und Konzepte fur den Nachhaltigen € Einsatz von Vorlesungsaufzeichnungen," Ph.D. dissertation, Albert-Ludwigs-Universit€at Freiburg, Freiburg im Breisgau, Germany, 2011.

[12]. R. Mertens, H. Schneider, O. Muller, and O. Vornberger, € "Hypermedia navigation concepts for lecture recordings," in Proc. World Conf. E-Learning Corporate, Government, Healthcare, Higher Educ., 2004, pp. 2840–2847.

[13]. V. Schillings and C. Meinel, "tele-TASK-Teleteaching anywhere solution kit," in Proc. 35th Annu. ACM SIGUCCS Conf. User Services, Providence, RI, USA, 2002, pp. 130–133.

[14]. Olivier Aubert, Yannick Prie and Camila Canellas ´ University of Nantes, LINA - UMR 6241, Nantes, France," Leveraging video annotations in video-based e-learning"

[15]. M. Ketterl, O. A. Schulte, and A. Hochman, "Opencast Matterhorn: A community-driven Open Source Software project for producing, managing, and distributing academic video," Interactive Technol. Smart Educ., vol. 7, no. 3, pp. 168–180, 2010

[16]. F. Grunewald, H. Yang, E. Mazandarani, M. Bauer, and C. Meinel, € "Next generation tele-teaching: Latest recording technology, user engagement and automatic metadata retrieval," in Proc. Int. Conf. Human Factors Comput. Informat., 2012, pp. 391–408.