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AUTOMATIC QUESTION PAPER GENERATION USING MACHINE LEARNING APPROACH

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Abstract
In any educational course curriculum, the courses are defined with learning objectives. Teachers conduct assessments to know if students have achieved certain learning objectives or not. Teachers generate variety of question papers as per the universities' assessment requirements. It is very challenging for the teachers to make question paper with varied questions and which meet learning objective of the course. There are no standardized methods to ensure quality of question paper. Hence there arises a need to have a system which will automatically generate the question paper from teacher entered specification within few seconds. Researchers recommend different sets of tags such as cognitive level, difficulty level, type of question, etc. The existing tool are rigid and support very basic or limited tags. The proposed system will automatically generate a question paper from semantically tagged question repository.

Keywords: Machine Learning, Latent Semantic Analysis, Question Paper Generation

1. Introduction

In the present competitive world, an examination plays a crucial role in checking the intellectual growth of students. In fact, the quality of the students is judged by the nature of the exam questions of particular institutions. Thus examination is the only measure of competence in the current education system of our country and has a decisive role in career building of students. For various examinations conducted in a year in any academic course, teachers need to generate variety of question papers as per the universities assessment requirements. The university guidelines concentrate only on the format of the question paper rather than on the quality of the question paper. It is very challenging for the teachers to cover all aspects of the course objectives and avoid duplication of questions in the subsequent exams. There are no standardized methods and hence the quality of the question paper depends completely on an individual teacher's experience and expertise. The fact that there is shortage of experienced teachers makes situation even worse. At times, all these factors may deteriorate quality of the question paper. As per researchers, a good question paper is a proper blend of items (questions) guided by various parameters such as cognitive level, difficulty level, type of item, distribution of marks across the question paper, etc. Making a good question paper containing varied questions aligned with learning objective of the course in terms of contents and cognitive level is very difficult. A good question paper is always fit for ordinary students but it also encompasses challenging items for intelligent students. The existing Learning Management Systems (LMS) support very basic level or limited tags such as question types. Even the most preferred LMS, Moodle allows creating only subjective/objective type of questions. Thus automatically generating question paper from a teacher's entered specification using a semantically tagged QR is the need of the hour today. The system to semi automatically tag the questions of a repository is in place. Here we are proposing a system which automatically generates the question paper from this semantically tagged question repository. Since the existing systems are rigid and lack the flexibility of supporting all types of tags, the generated question paper may not be totally aligned with its given objectives. Our system supports all four tags and also flexible enough to provide an interface that allows user to enter specifications for each tag/property in the form of lower and upper bounds. Each property is specified with a range indicating that value should not be lower than minimum value and not exceed the maximum value of the range. Also, it is rule base system which takes all the combinations of the tags and generates output based on the rule applicable. The output is generated in xml format and in word document.

2. Literature Survey

A literature survey was started to understand the need for automatic generation of question paper. As mention in [1] this paper proposed a flexible system offering a semantically tagged question repository for automatic question paper generation in the normal course teachers are responsible for conducting an assessment of a students learning outcome.

In [3] presented a software system which helps to find the solution on the basis of various input rules some of the major rules like difficulty level of the output, type of selection found the stored data, and the type of cluster can help to form a better quality output for the user. The system process the input rules from the user and compare with the stored data set to form a question paper in the form of document file. The proposed system is easy to understand due to the interface parameter selection and more reliable as compared to currently used or developed system.
In [6] a system which offers generation of question papers using user given input parameters considers only fixed range of values.
In [7] a system has proposed two strategies for intelligent paper generating .
1.Block selection
2.Backtracking
In[8] a system has proposed a framework for creating question paper. The quality of question paper depends on the various constraints like question paper format., coverage of syllabus, coverage of difficulty levels coverage of cognitive levels.In[9] the system proposed thes structure of question database, paper database and template database are discussed. Using this system user can choose question paper setting manually.
In[10] the system has proposed a way to decompose table and store the extracted data in structured data format(XML) for easy reuse. Table Extraction is process of decomposing table information in document.

3. Proposed System

The proposed system would be used by schools, colleges, institutes to frequently generate question paper with ease. We have implemented a system that facilitates automatic generation of question paper from semantically tagged question repository.

The teacher and admin authentication will be done. The admin has right to add department, teacher staff. The teacher has right to add question bank into question repository in any format like text, PDF or word. Teacher can give difficulty level to questions. After generation of question paper the question will be saved in question repository. The Machine learning algorithms are used for generation of question paper.

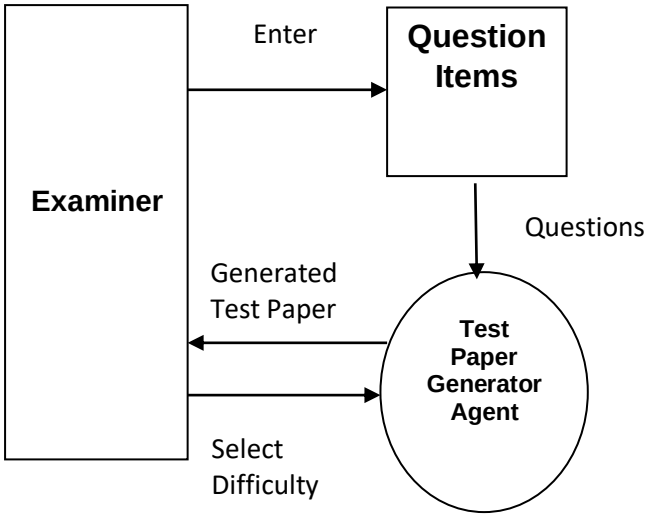


Fig1. Flow of Proposed System

4. Architecture

We have two sections 1.Admin login 2. Teacher login. Admin module consist of staff management , department management, subject management . Teacher module consist of add question bank and generated question paper will be added to teacher section.
The work flow of the proposed framework is implemented as follows :

1. When the application starts the teacher and admin authentication takes place.
2. The admin has right to add department, teacher staff.
3. The teacher has right to add question bank into question repository in any format like text, PDF or word. Teacher can give difficulty level to questions. After generation of question paper the question will be saved in question repository.
4. The Machine learning algorithms are used for generation of question paper.

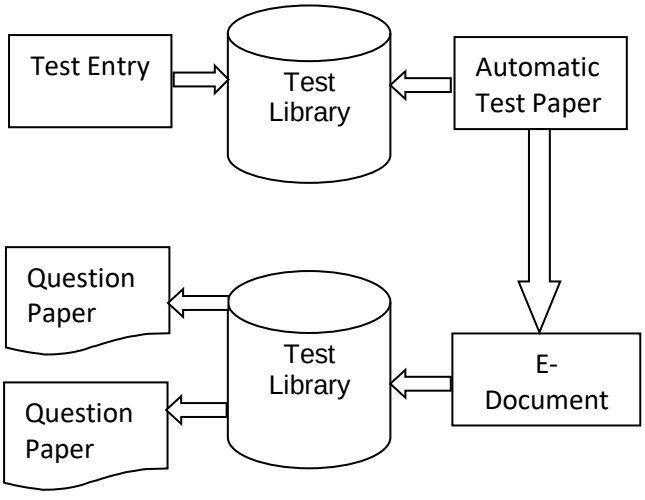


Fig2.Architecture of Proposed System

5. Implementation Details

The system is implemented as a web application using Visual Studio with ASP.NET which implements Model-View-Controller (MVC) pattern. For database we have used SQL Server Management Studio 2017.

A. Login Module

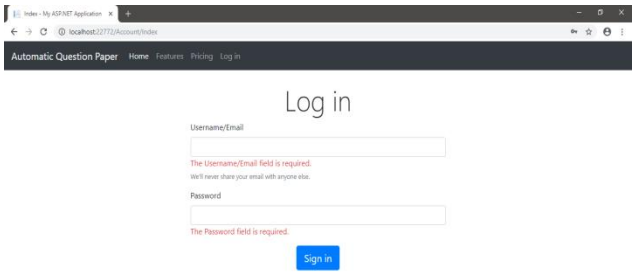
The first web interface allows user to login as Admin while the second one allows to login as teacher.

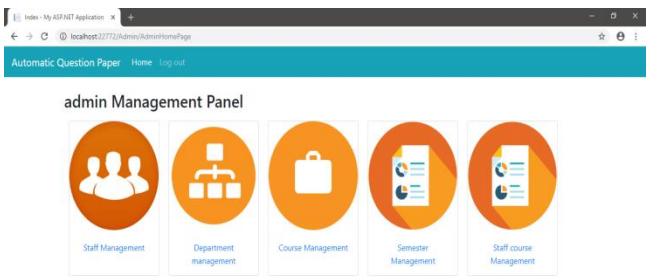
B. Admin Login

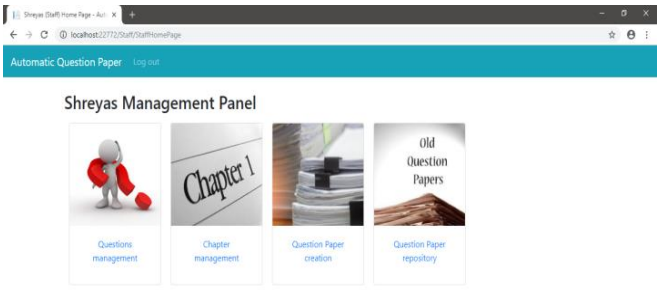
Admin can manage department their respective staff and courses. In department management admin can add or remove department. By selecting department admin can add or remove staff also can assign different courses to respective staff.

C. Teacher Login

In teacher module teacher can add question banks to question repository. Teacher can add question banks in the form of CSV file, Excel file or Word file.
Question paper creation module will generate question paper in PDF or word document.







Methodology

The staff has to login to system via username and password (staff can be added to system by admin).After login in order to create question paper. Staff has to add first chapters in the subject assigned to them by admin. The chapter management section is responsible for chapter operations. Where staff members can add, edit and delete chapter here.
Then after adding chapter, staff members can add question to those chapters via question management section. The implemented system takes input in the form of question banks which includes no. of questions . Also the teacher can provide any paragraph to generate question on the basis of given paragraph.
The question banks can be given in the form of PDF, word document. From the PDF we use PDF Extractor to extract each question separately from the PDF.
Questions can be generated from the paragraph also. We used python technology .
While adding questions to repository the system checks for question duplication so that system can ensure that no similar questions will be added.
Our system would find semantic meaning of question which will reduces the repetition of similar types of questions in automated generated question paper. To do this we have used Latent semantic analysis.
Latent Semantic Analysis (LSA) is a technique in natural language processing. LSA will analyze the words that are close in meaning will occur in similar pieces of text. A matrix containing rows represent unique words and columns represent each paragraph is constructed from large piece of text. Using this approach the accuracy of our question paper will increase. And question paper will be generated.
And if system finds the similar question then it provides various option to staff to take action on it like editing the existing question, deleting the old similar question and keeping them both.
After this staff can create question paper in question paper creation tab. The system will check the availability of questions in repository as per pattern and type selected by staff member before going to create question paper.

Latent Semantic Analysis Method
1. Start with a Term-by-Document Matrix(A)
2. Optionally weight cells
3. Apply Singular Value Decomposition
- t = # terms
- d = # of documents
- n = # min(t, d)

At*d = T t*n X Sn*n X (Dd*n)T
4. Approximate using K(Semantic) dimensions:
At*d = T t*k X Sk*k X (Dd*k)T

Generation of questions from paragraph:
1. Accepts a text file as an argument and generates questions from it.
2. Send the content of text file as string to function parse()
3. Each sentence is taken from the string input and passed to genQuestion() to generate questions.
4. Create a list of tag-combination.
5. With the use of conditional statements the dictionary is compared with the list as follows:

NNS Noun, plural
NNP Proper noun, singular
VBG Verb, gerund or present participle
VBN Verb, past participle
VBD Verb, past tens
PRP Personal pronoun
NN Noun, singular or mass

6. When the tags are generated 's is split to ' and s. To overcome this issue.
7. Print the generated questions as output**.**

6. Expected Result

Given input data set the system output will is any type of question format. The format will be in word, PDF, text format. Question weightage can be given by teacher. No repetition of question will be generated as we are checking for semantic meaning of question. Multiple question paper can be generated any time.

7. Application

The system can be used to generate the automatic question paper for university, organization, institutes and other private coaching classes**.**

8. Conclusion

Proposed system will help colleges and university to create effective question paper. The system's major Characteristics are openness, convenience and flexibility. The system allows the university and colleges to act According to their demands and extract each kind of test question quickly from the existing trial question bank to suit an examination paper developed according to the colleges' needs. Moreover, the examination paper's difficulty level and form as well as each topic score are determined by the colleges and university according to their needs. The colleges logs on the system after effective identification authentication in the browser, extracts the paper. By using proposed system the question paper will be generated in PDF or word format.

9. Acknowledgement

It has been rightly said that we are built on the shoulder of others. For everything we have achieved, We thank to our project guide Prof. S. B. Bhonde for encouragement, guidance and support. We are also thankful to SPPU, Pune for permitting us to carry out our project work.

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