Framework for Automatic Examination Paper Generation System

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Framework for Automatic Examination Paper Generation System

[1]Ashok Immanuel, [2]Tulasi.B
[1,2]Christ University, Bengaluru, Karnataka, India

Abstract
Knowledge has considerable impact on functioning of society. Information and knowledge are two main pillars on which progress of mankind stands. To create competent citizens educational institutions play a pivotal role and they need to reinvent the process of teaching learning to achieve it. One of the means of identifying the impact of teaching learning is assessment. Assessment plays a pivotal role in complementing the learning process. With the evolution of technology, the assessment methodologies also have been transformed. Greater blending of technology into teaching learning process is inevitable. Standardization of test papers has always been an issue of concern. Assessment should be designed to test a learner on various aspects of learning. A manual approach for designing a test paper would not be able to cater to this requirement. An automated approach would allow the process of designing test paper to be more efficient and effective. It would also facilitate in generating a database of questions which could be further categorized for homogenization of test paper. This paper proposes a framework to automate summative test papers.

Keywords
Knowledge Society, Cognitive Skills, Learner centric Question Aggregator, Bloom's Taxonomy, Three Tier Model, Syllabus Engine and Pattern Composer

I. Introduction

Knowledge is a key resource and driving force for economy of 21st century. The era of information technology is now replaced by effective utilization of the technology. Creating value from knowledge is pivotal for evolution of society into a "Knowledge Society" [12]. This emphasises the need to develop individuals with potential to create value from "meta knowledge" available. The need for maximizing the effectiveness of teaching learning process thus arises.

Learner Centric approach has been in vogue for more than a decade. It is seen instrumental in enforcing the learning objectives, far more effectively than the traditional teaching pedagogy. Technology has enabled varied experimentation in Teaching Learning process. This has levitated the evolution of learner centric teaching with newer dimensions. Learner Centred teaching provides avenues for learner to "think","identify problems", "Solve","Analyze and Evaluate". It also allows them to develop learning skills which is scarce in the traditional approach.

Collaborative learning style is one of the main characteristic of learner centric model of teaching. It allows the learner to engage in activities beyond the conventional classroom sessions. Communications among virtual learner community provide a platform for knowledge sharing. The collaborative approach dissolves the structured role of "Educator" and "Learner" where both the stakeholders play both the roles at different stages of learning. This facilitates augmentation of both educator and learner thus enriching the educational experience.

Assessing this learning requires the process to imbibe newer elements into it. The learning achieved through leaner centric approach cascades against the conventional model and needs to be evaluated with a newer model which is espoused by technology. Assessment is a critical element in the process of teaching and learning. The quality of assessment has an unswerving link to student performance. Assessment is a systematic basis for making inferences about the learning and development of a learner. Assessments should deliberate to enhance, educate the learner and not merely audit. Assessment and evaluations are two different rudiments of the same process, which provides the stakeholders good insight into the outcomes of teaching learning.

Assessments are of many forms: Diagnostic, Formative, Summative, Norm-referenced, Criterion referenced and Interim/ Benchmark [1]. Summative assessment is one of the important types of assessment which is followed in many educational systems around the globe. Though summative assessment can be conducted in many ways "Unseen exam" is the one which is prevalent. Quality of examination paper has always been a primary concern of any evaluation system [5]. There have been deliberations regarding the quality of the question papers being given to the learners in these examinations.

Various theories are available for testing the knowledge and cognitive skills of a learner. Some of the renowned theories include the Bloom's taxonomy. Categories in the cognitive domain of the revised Bloom's taxonomy include Remember, Understand, Apply, Analyse, Evaluate and Create [1]. Bloom's taxonomy emphasises the need to identify the different types of learners based on the varied skill sets. Any examination paper which tests only one category of cognitive skills or only the learning outcomes cannot be considered as a standard question paper. Hence questions assessing different levels of the knowledge of the learners should be available in a examination paper [2]. The traditional approach of assessment had been more on memory retention skills, focusing on retention of the concepts dealt. The effectual combination of assessing problem solving, critical thinking and conceptual understanding are imperative criterion of a good model of assessment [6].

The process involved in preparation of a balanced examination paper by an individual is demanding and complex [4]. Quality of the examination paper depends on varied set of parameters. Considering the different levels of learners is also an important parameter. The course objective too plays an important role in designing an efficient question paper. Aligning the learning objective of the course to the examination paper is also an intense task. With the profound diffusion of technology in the field of education, adopting technology to facilitate the process of examination paper generation is a natural option. Question bank and automatic paper generation provides a key solution to the problems faced during the manual preparation of examination papers.

Automatic generation of examination paper provides a platform to generate an efficient examination paper. The automation would facilitate in encompassing many factors influencing quality of a question paper [3]. The framework proposed in the next section is to automate the process of examination paper generation. The engine would be consisting of a collection of questions upon which rules would be applied to generate question paper. The

framework is generic and is not for any particular branch of learning. It tries to provide a generic methodology to the varied needs of different fields of study. This generic framework can be adapted to all departments in a university thus facilitating the evaluation needs

II. Question Bank Engine - Framework

The proposed question bank engine is based on evaluation system, where a university conducts a summative exam at the end of tenure either bi-annually or tri-annually. Most universities would be conducting these assessments for variety of programs under different fields like Science, Social Science, Commerce and Management, Engineering, Medical. Universities may have many affiliated colleges under its fold. Typically a university may offer thirty to forty undergraduate and post graduate programmes under departments. Number of programs and the courses offered in them is overwhelming. With most of the graduate programmes involving three years of study and the master with two years of study, the number of courses offered in a semester would range anywhere from five hundred to six hundred. This hurricane task would involve tedious, meticulous planning and implementation. Lack of automation would complicate this process to a great extent. The inherent problem of a balanced paper adds on to it.

Considering these challenges the proposed framework provides platform to aggregate questions, classify them, and associate them with the syllabus of the course. This helps in construction of a system which would facilitate the standardization of assessment to a greater extent. It also tries to provide flexibility in defining the classification criteria which could be distinct for every educational institution.

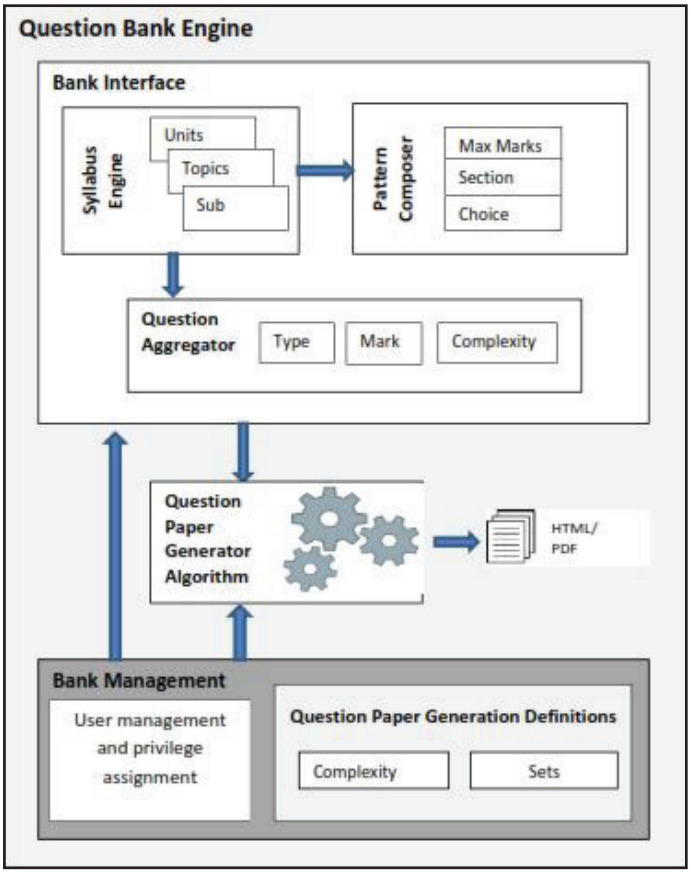

Fig. 1: Question Bank Engine

The framework as shown in fig. 1 is based on client server architecture. It would be a three tier model involving the question aggregator which would be the Question Bank, Examination paper generation algorithm which would provide for the logical tier and the Bank interface, the interface for the user.

The engine is a three tier model consisting of the data tier, business logic and user interface. It provides a generic framework for automation of examination paper for different programs with varied needs [11].

A. Presumptions of the Engine

The engine has been designed considering the following presumptions.

1. Any course for which a examination paper has to be generated contains a well-defined course content which would be taught or left for self-study.
2. Each course has a unique name and code tone identified uniquely.
3. The engine may have its own algorithm to generate unique code for each course which will be used for its internal management.
4. Business rules need to be well defined and unambiguous in nature.

B. Components of the Engine

The question bank engine can be viewed as at least three segments. The Bank Interface which act as the user interface through which the various inputs necessary for the examination paper generation are gathered. The second segment is the Bank Management which deals with the user management and privileges. The third segment is the Examination Paper Generator which generates examination papers considering the various parameters such as toughness degree or the complexity, pattern and number of sets required.

C. Bank Interface

A user, presumably the course teacher who has been given privileges to access the engine, is responsible for three important tasks namely syllabus engine, pattern composer and question aggregator.

D. Syllabus Engine

The role of the syllabus engine is more of an aide than an absolute necessity. Even though it is recommended that an exact copy of the syllabus which was followed for the course should be present in the bank at least the broad topics should be mentioned via the Syllabus Engine. This comes in very handy for the pattern composer and the question aggregator phase. The pattern required by this framework is not just a mention of the marks distribution but a insight about which question to be picked. This provides unique relationship between the pattern and the syllabi of the course [8].

Each course offered for a programme will have multiple units or modules. The content taught in a course is divided into sections. The division can be based on the teaching hours required or based on the concepts to be covered. Though such divisions are not directly related to a question bank yet it is recommended to have such divisions for ensuring the questions that are chosen randomly are evenly distributed across the entire subject of study. The division of the course content also has a relation with the pattern which will be discussed under the pattern composer.

E. Pattern Composer

The skeleton of the examination paper to be generated is defined under the pattern composer module. A blueprint of the examination paper should be defined in this section. The user is free to create any

kind of question paper. Question papers might have a single section or multiple sections. Pattern composer establishes relationship with syllabus engine by providing the flexibility to choose questions from the various divisions created through syllabus engine. Various subsections of the examination paper is defined by the pattern composter. Provision for composite questions can also be provided in which each question can be a combination of one or more questions forming sub divisions in the question. Against each question the unit, the topic and the sub-topic from where the question has to be picked should be mentioned. Internal choice or section wise choice can be specified. Multiple patterns can be created depending on the requirement of the type of the examination.

F. Question Aggregator

The third segment of the Bank Interface is the Question Aggregator. The questions will be entered through this module. Every question can be viewed as an object, therefore the question class should contain attributes namely, a question type, a complexity factor and the mark weight age. Some of the question types which we can enumerate includes multiple choice question or objective type question, descriptive question, numerical problems, fill-in the blanks and state true or false.

G. Bank Management

The system has to be secured against data theft and data manipulation. An effective user management has to be done to secure the question bank and hence maintain the sanctity of the question paper. More than one user can be allowed to add questions for a course but should not be able to edit other user's questions.

H. Question Paper Generation

The question paper generator considers the complexity required the number of sets of question papers to be generated. The algorithm for generating the examination paper picks up a question according to the pattern defined and on successful pickup marks the question so that the same question may not be selected in two subsequent examination paper generation. The output of a successful generation can be stored as pdf for further printing and reprography.

III. Conclusion

Evaluation plays an important role in teaching learning process. Aligning evaluation to the learning outcomes of the course is an essential aspect. Manual preparation of the question papers poses many other challenges apart from the fact that preparing a standard examination paper involves lot of commitment from the individual. Challenges which can be noted are examination paper can become biased either too tough or too easy, Questions may not encompass the entire syllabi ignoring parts of the syllabi, If there are no mechanism to check, then questions may be repeated in the consecutive question papers which could make it predictive. The proposed system tries to address the above mentioned issues in an efficient way.

The pedagogy of teaching learning is being revolutionized to cater the varied needs of the learners. This also influences the evaluation system to reiterate the advantages of the new pedagogy to the learners. The automation of test paper would be a competent way of ensuring the pedagogic transformations are delivered ably. The proposed framework caters to the challenges faced by evaluation process in the current knowledge driven society.

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