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Automated Exam Question Generator Using Genetic Algorithm

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Abstract - *Manual preparation of exam questions require a lot of work to be done to make sure that all the guidelines given by educational institutions are followed by educators during preparation of exam questions. It requires lots of educator's efforts and time since it is tedious and meticulous which can sometimes lead to human mistake. Sometimes, question papers are under debate for their levels of toughness and lengthy content. The works of question paper setting and evaluation become more important, particularly when students come from different background and board. The purpose of this project is to ease the educator's work in the process of preparing exam question paper using Genetic algorithm. The generator can auto generate new exam questions set using Genetic Algorithm and covers six levels of Bloom's Taxonomy to produce high quality exam questions that can evaluate different level of learners based on Bloom's cognitive domains and the selection of chapters made by educators.*

***Key Words*: Automated Exam Questions Generator, Bloom's Taxonomy, Artificial Intelligence, Genetic Algorithm, Cognitive, Random Search.**

1.INTRODUCTION

The main reason behind this project is to facilitate the instructor's work during the time spent getting ready exam question paper and giving them more opportunity to focus on showing materials and fortify their training methods without being loaded with the exam question paper arrangements. In the present age, education is the most significant method for making progress. While talking about training, it is basic to make reference to tests and examination. Examinations get ready students as they continue looking for knowledge. Along these lines, having an appropriate examination paper and format is very vital.

A good quality of exam questions can decide capability of students and may likewise mirror the quality work of teachers and their instructive organizations. A good exam paper should comprise of different difficulty levels to endure the distinctive capacity of students. This project builds up a model of Automated Exam Questions Generator that can create Exam Questions dependent on Bloom's Taxonomy levels and sections picked without rehashing past questions in two back to back years. As indicated by Bloom's six different cognitive stages in learning; the straightforward review or acknowledgment of facts is considered as the lowest level into the increasingly more complex and abstract mental levels as the highest order, which is delegated evaluation. It is a web-based application that can be broadly utilized in the educational institutions. This framework likewise assesses the competitor's capacity and aptitudes effectively. It is completely mechanized framework which produces quick outcomes. The use of this framework lessens educator's endeavors and spares time and assets to an extent.

1.1 LITERATURE SURVEY

The author Ashok Immanuel and Tilasi B [1], has proposed "Framework for Automatic Examination Paper Generation System," based on evaluation system where a university conducts exam at the end of every year. The framework is based on the client server architecture, it would be a three-tier model involving the question aggregator which would be the question bank, Question Paper Generation Algorithm which would provide logical tier, bank interface and interface for the user. This 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.

The author S. Pandey and K. Rajeswari [2], "Automatic Question Generation Using Software Agents for Technical Institutions," has proposed "Framework for Automatic Examination Paper Generation System," is based on generating questions based on Bloom's taxonomy which enables to generate the questions that help to assess learning ability of the students. The proposed framework helps in question generation by deploying agents, the agents will perform various operations like document processing, information classification and question generation. Thus, system may also be termed as a multi agent system.

The author K. Naik, S. Sule, S. Jadhav and S. Pandey [3], "Automatic Question Paper Generation System using Randomization Algorithm," is based on the usage of shuffling algorithm in Automatic Generator Question Paper System (GQS) to overcome the mentioned problem. The main part of

the shuffling algorithms is to provide randomization technique in question paper generation system, thus different sets of question could be generated without repetition and generation of question paper using randomization by means of shuffling algorithm. Shuffling algorithms is a suitable and very effective way to implement for randomization of stored questions. This algorithm checks for duplication and repetition of the randomly generated questions. The main purpose of this application is to describe automatic question paper generator using shuffling algorithm for randomization. This system is web-based as well as desktop-based application system with several features mainly producing unduplicated sets of exam paper.

The author D. Liu, J. Wang and L. Zheng [4], proposed the "Automatic Test Paper Generation Based on Ant Colony Algorithm," which is based on test paper coding is the first question automatic test paper generation based on ant colony algorithm needs to solve. As binary coding mode is the most commonly used data representation it is therefore this dissertation that adopts binary coding mode to code test papers. As a result, the whole binary code can be divided into different functional blocks according to question type; each functional block corresponds with a kind of question type. The speed of random drawing is relatively slow, test paper generation costs a long time and the efficiency of such generation is extremely low. Test Paper Generation Based on Ant Colony Algorithm is searching performance rather than the quality of test paper generated where the difficulty and level of test paper are ignored. Automatic Question Paper Generator System (QGS) and Automatic Test Paper Generation Based on Ant Colony Algorithm did not cover the difficulty and level of exams question.

1.2 PROPOSED SYSTEM

The proposed framework is extremely valuable for the teachers and students. This dodges the test question paper spillage which was influencing students who are making a decent attempt to get great stamps on those tests. As a teachers' work can get limited the worry of setting question paper and directing tests become so straightforward and furthermore can keep basic archives. We isolated this segment into three phases where we will portray the theoretical framework in the primary stage, the improvement and development of the Automated Exam Question Generator in the second stage and the Genetic Algorithm for the Automated Exam Question Generator in the last stage.

2. ARCHITECTURAL DESIGN

Having a "clean integral structure" is essential for constructing a system that is understandable, maintainable and testable. It is only through having a clear sense of a system's architecture that becomes possible to discover common abstractions and mechanisms.

Previous exam questions will be processed and stored in questions bank for the input Automated Exam Questions Generator. The educator may also create new exam question and store into question bank for future use. The educator can choose the chapters to be covered in exam questions. The Automated Exam Questions Generator will generate new exam questions based on six levels of Bloom's Taxonomy and chapters selected by the educator.

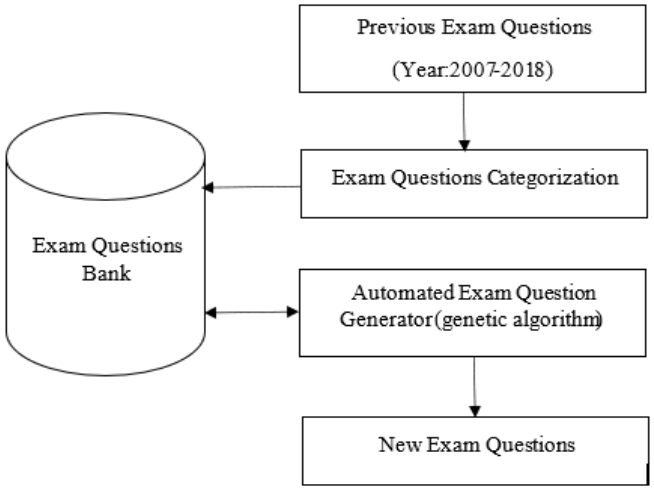

Fig -1: Architectural Design of paper generator

We will utilize Java as the programming language to develop the prototype, NetBeans will be used as an Integrated Development Environment (also known as IDE) and MySQL will be used for structural database to develop Automated Exam Question Generator.

Table -1: Software Requirements

Type	Description
Programming Language	Java version 1.8.0_65
IDE	NetBeans 8.1
Database	MySQL version 5.6.16

The past exam questions from year 2007 until the year 2018 will be extricated and put away with its Bloom's Taxonomy level in Exam Questions Bank utilizing a straightforward word matching function where Bloom's Taxonomy Level for each question from past test questions can be classified dependent on the word in the test question with Bloom's Taxonomy word list. After word matching function is executed, the uncategorized past exam questions; where there is no match found for the question and Bloom's Taxonomy word rundown will be refreshed or updated manually. The Automated Exam Question Generator will create new exam questions dependent on Bloom's

Taxonomy Level and chapters picked utilizing Genetic Algorithm.

Here are the tables which will store the related details:

• Course: Course related e.g. course name and code.

• Syllabus: Syllabus related e.g. chapter and chapter title.

• Bank: Previous exam questions.

• Semester: Semester related e.g. semester code, month and year.

• Set: Exam questions set details e.g. semester code and course code.

Genetic Algorithm The generic process of Genetic Algorithm is listed below:

• Step 1: Initialization

• Step 2: Evaluation

• Step 3: Selection

• Step 4: Crossover

• Step 5: Mutation

• Step 6: Repeat step 2 until a desired solution is obtained

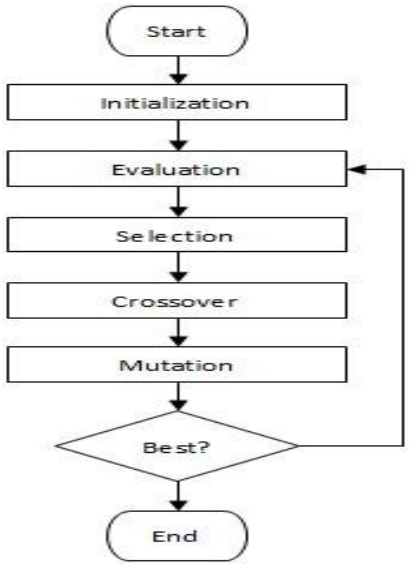

Fig-2 Flowchart of Genetic Algorithm

At first, five beginning populations will be made by arbitrarily choosing questions from separated question bank. A basic query has been executed already to channel every one of the questions in the bank so the age of new test addresses will comprise of just questions from picked chapters and reject past questions from question papers of two continuous years to avert prescient paper design. Every population comprises of gathering of chromosomes and every chromosome comprises of genes. Every chromosome refers to question paper and every gene refers to an questions in the test set.

Secondly, every chromosome of the population will be assessed and fitness value will be determined for that singular chromosome. The fitness value will be determined dependent on Bloom's Taxonomy Classification (The six levels of subjective spaces with various level of competency) and nature of test questions weightage rate is as follows

Table -2: Bloom's Taxonomy Classification

Level1	Knowledge	Easy
Level2	Comprehension	
Level3	Application	Medium
Level4	Analysis	
Level5	Synthesis	Hard
Level6	Evaluation	

The nature of test questions weightage rate is resolved dependent on the inclusion of Bloom's scientific classification where Knowledge and Comprehension levels are assembled as Easy; Application and Analysis levels are gathered as Medium; and Synthesis and Evaluation levels are assembled as Hard.

Table-3 Quality of exam question weightage percentage

Good	6 Level	Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation	100%
	5 Level	Knowledge, Comprehension, Application, Analysis and Evaluation	90%
	4 Level	Knowledge, Comprehension, Analysis and Synthesis	80%
	3 Level	Comprehension, Analysis and Synthesis	70%
Medium	4 Level	Comprehension, Application, Analysis and Evaluation	60%
	3 Level	Knowledge, Application and Evaluation	50%
	2 Level	Analysis and Synthesis	40%
Bad	2 Level	Application and Analysis	30%
	1 Level	Synthesis	20%

The great quality of exam questions covers each of the three Bloom's scientific categorization order for example Simple, Medium and Hard. The mid-range nature of exam questions comprises at any rate two Bloom's scientific classification arrangement; either Easy and Medium blend or Medium and Hard mix or Easy and Hard mix. The bad quality of exam question just covers one Bloom's scientific categorization order. The formula in (1) is utilized to figure the fitness value for every chromosome. W is the estimation of exam questions quality weightage rate.

$$1 / W \qquad (1)$$

Thirdly, the best population is demonstrated by the most reduced estimation of fitness value among five starting population and the selection is finished. Fourthly, single crossover is utilized with the crossover point picked arbitrarily to upgrade the fitness value of produced chromosome.

The Fig. 3 represents the control flow diagram of the designed question paper generator.

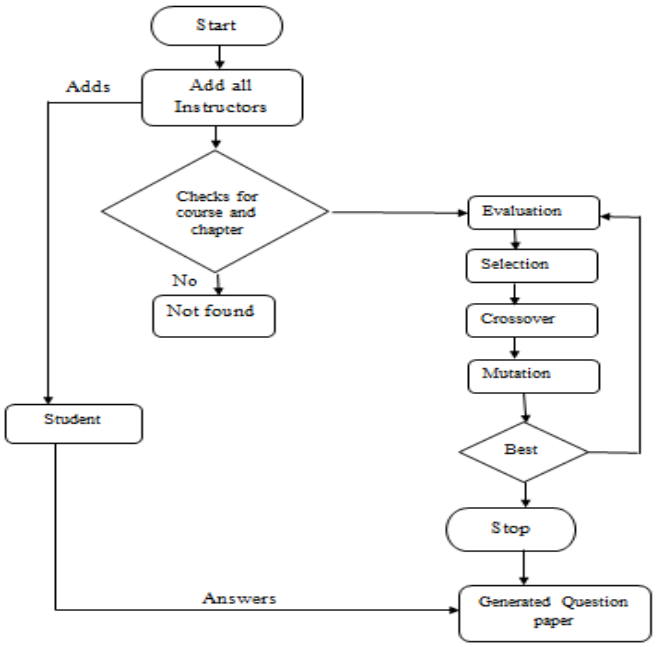

Fig-3 Control Flow Diagram

Admin can add the instructors after which instructors can choose the required course and chapter. The question paper is generated using Genetic Algorithm, which covers all the steps of Genetic Algorithm which are Evaluation, Selection, Crossover, Mutation. Once the generated question paper is optimal, it is presented to the students to answer.

It is necessary that analysis of all system procedures and data requirements should be documented at the time of system development. The interface design of Automated Exam Question Generator is shown in Figure 3 below:

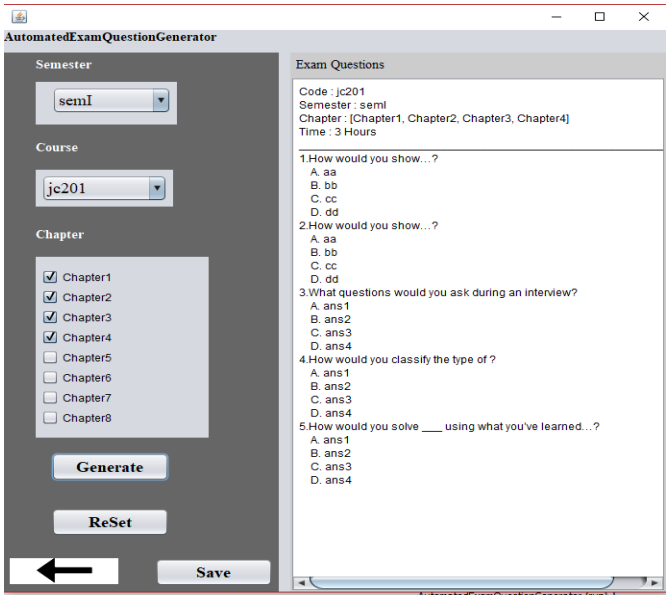

Fig -4 Automated Exam Question Generator

A new question paper is generated by choosing required course name, subject code and chapters. On-click of the generate button exam paper is generated. Reset button helps to reset the generated paper.

3. RESULTS AND DISCUSSIONS

The degree program typically comprises of five Multiple Choice inquiries, in this way the absolute number of test questions is introduced as five. The Automated Exam Question Generator expects teachers to pick course code, exam question set and sections before test questions can be created. The nature of test questions weightage rate depends on the dimension of psychological area secured and it has been characterized as fitness value for this model. The low fitness value implies that high quality test addresses will be produced. Each experiment utilizing diverse number of sections chose. The created exam questions from this model appeared in Fig-4 the normal estimation of exam questions weightage rate is 70%. The most elevated exam questions weightage rate is 90% and the least exam questions weightage rate is 40%. The end result of this research affected by the smaller number of existing questions for each Bloom's Taxonomy level in question bank.

4. CONCLUSION

The Automated Exam Question Generator has been created utilizing Genetic Algorithm to diminish teachers' weights during the time spent test addresses arrangement. At present, it centers around multiple-choice questions as it were. This exploration can be stretched out to utilize different sorts of questions, for example, short questions,

paper questions, fill in the clear questions and genuine false questions. Besides it additionally can be utilized to create test or test questions. In future, other kind of calculations can be connected to Automated Exam Questions Generator that has been created so as to build its presentation and the nature of test question produced.

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