Automatic Online Test Paper Generation Using STG

[1]T.S.Kishore, [2]Selvakumarsamy
[1]M.Tech Student, [2]Assistant Professor
[1,2]Dept of Software Engineering, SRM University, Kattankulathur, Chennai, India-603203
[1]tsk0889@gmail.com , [2]selvakumarasamy.s@ktr.srmuniv.ac.in

***Abstract*-Static test generation (STG) is a technique used to generate the test paper automatically according to the user specification. The generated test paper will be attempt by the user through the web and submit for solution checking. STG will automatically checks the solution and publish the result to the user. Tabu Search (T S) is an algorithm which is used to construct the test paper quality. It allows further changes in the question paper after the test paper generates. This could be enhanced by admin to add and update individual question paper after the question paper generate. It also provides the feedback to the user automatically according to their performance.**

***Index Terms:* Web-based testing, Static test generation, multi-objective optimization, Web Browser**

I. INTRODUCTION

For online test paper generation it used to generate the test paper based on multiple assessment criteria. It aims to find a subset of questions from a question database to form a test paper based on user specification on total time, topic distribution, difficulty degree, topic distribution, question type distribution. Web-based testing has been popularly used for automatic self-assessment especially in a distance educational learning environment [2], [3]. However, there is a problem on conducting self-assessment in an online class. As there may have many students5 with different proficiency levels in an online class [4], it is difficult to fulfill different assessment requirements of students if using tests composed from a small question pool [5].

One promising approach to support the automatic test paper in web is static test generation (STG), which generates a test paper automatically according to user specification based on multiple assessment criteria. First, automatic calibration of question attributes should be supported to generate large-scale data sets. Second, the current approach could be extended to support the generation of multiple test papers simultaneously based on the same test paper specification. Therefore, to evaluate users in an online class, different test papers of equivalent or similar properties can be used. Finally, the current system does not allow further changes on individual questions of a generated test. This could be enhanced by allowing admin to add and update individual questions of a generated test paper. As such, the web-based testing system will be more flexible in creating test papers for online test.

Tabu search algorithms which have been proposed in the research community for automatic test paper generation. However, this technique generally generates good test papers. However, there is a problem on conducting self-assessment in an online class. As there may have many users with different proficiency levels in an online class, it is difficult to fulfill different assessment requirements.

II. RELATED WORK

There are two major paradigms for web-based testing: STG [6] and computerized adaptive testing (CAT) [7]. STG Generates full test papers automatically based on multiple assessment criteria, whereas CAT generates question-by question tests in a dynamic and sequential manner according to student's ability and item response theory (IRT). STG is basically a multi objective combinatorial optimization problem, whereas CAT is a sequential optimization problem [8]. In this section, we focus only on reviewing related work on STG, which can be categorized into two main groups: linear programming based integer programming and heuristic-based methods. LP-based IP, which was proposed in 1986 by Adema et al. [9], [10], used the LANDO program to solve the 0-1 ILP of STG. It is similar to our proposed approach because of the use of linear programming (LP) and branch and bound. In [8], [9], Boekkooi-Timminga attempted to combine ILP with heuristics to improve runtime performance for multiple test paper generation. Although these approaches have rigorous mathematical foundations on optimization, they can only solve STG for very small data sets of about 300-600 questions due to the limitations of the state-of-the-art optimization methods at that time. An in-depth review of the LP-based IP for STG can be found in [11]. For heuristic-based methods, Theunissen [11] used a heuristic based on the characteristics of question item information function to optimize the objective function. Later, Luecht [12] proposed an efficient heuristic to solve STG on a data set with 3,000 questions. However, these heuristic-based methods were proposed to solve STG for small data sets and are ineffective for larger data sets. Since 2003, there has been a revived interest for STG on larger data sets of about 3,000-20,000 questions by using modern heuristic methods. In [13], a genetic algorithm (GA) was proposed to generate quality test papers by optimizing a fitness ranking function based on the principle of population evolution. In [14], differential evolution (DE) was proposed for test paper generation. DE is similar to the spirit of GA with some modifications on solution representation, fitness ranking function, and the crossover and mutation operations to improve the performance. In [15], an artificial immune system was proposed to use the clonal selection principle to deal with the highly similar antibodies for elitist selection to maintain the best test papers for different generations. In [16], particle swarm optimization (PSO) was proposed to generate multiple test papers by optimizing a fitness function which is defined based on multi criteria constraints. In [17], ant colony optimization (ACO) was proposed to generate quality test papers by optimizing an objective function that is based on the simulation of the foraging behavior of real ants. Apart from these techniques for STG, an

efficient DAC approach [18] was proposed for online STG, which is based on the principle of dimensionality reduction for multi objective constraint optimization.

III. PROPOSED METHOD

In existing system there is problem in constructing the multiple number of same type of question paper at the same time overcome this problem we using the algorithm called Tabu Search In which it used to generate the test paper with less number of iterations. The multiple objective static tests are generated from the database constitute of questions in order to frame test paper for user and the evaluation of the test paper is done by the automatic solution checker as in the existing system. In the current paper admin can be able to add and update. It also provide the feed of student performance automatically according to their performance.

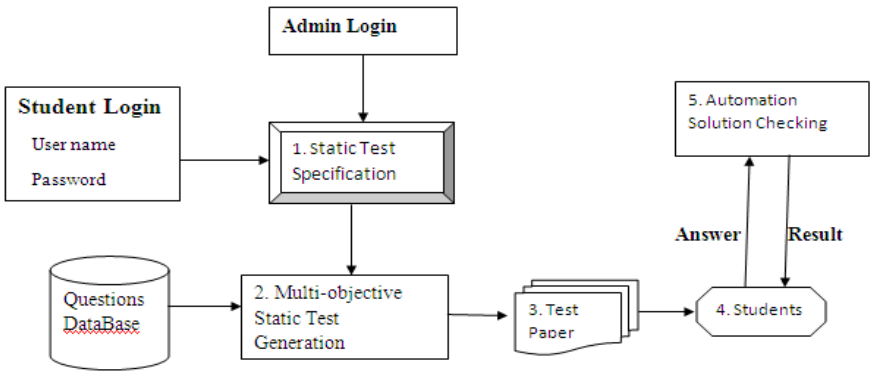

Fig 1 proposed system model

When user login the page using username and password STG is used to generate the test paper according to user specification. According to specification given by the user it will generate the question from question database and test paper will be generated. User attends the test and submits for solution checking. STG will automatically check the answer and produce the result to user. It also provide the feedback to user according to their performances

STATIC TEST SPECIFICATIONS

The Static test specification is S (N, T, D, C, Y) tuple of 5 attributes which is defined based on the attributes of the selected questions as follows.

1. Number of questions: Number of questions specified for the paper.
2. Total time: It is the total time specified for the paper.
3. Average difficulty degree: It specifies the average difficulty degree of all questions.
4. Topic distribution: It will choose the topic given in the paper.
5. Question type distribution: Choose the question format in DB.

IV. ALGORITHM

The current techniques such as dynamic programming, swarm intelligence and biologically inspired algorithms generally require long runtime for generating quality test papers. In this paper, we propose an efficient multi-objective optimization approach for Online-TPG.

To avoid this problem we are proposing Tabu search algorithm. It can choose the question according to the specification given by the user it will search the question randomly in question data base and display to the user in on-line test. TS (Tabu Search) is an algorithm used to construct the test paper based on parameters value for test paper. It is based on frequency based (long term) memory so it can able to generate best question paper. If a tabu solution encountered at the current iteration is better than the best solution found so far, Questions are store in the database.

V. APPLICATIONS FRAMEWORK

Online application- The proposed work can implement in online application using web page for access and to test their skills in web in different category. The proposed system framework which consists of the following components is web browser, web server, and database server using MySQL, STG, automatic solution checking and automatic giving feedback. With the proposed method schedule of the job is online generating the question paper with user specification. The proposed method useful for the online learning environment, because the user can gain their technical knowledge by attending the test in web.

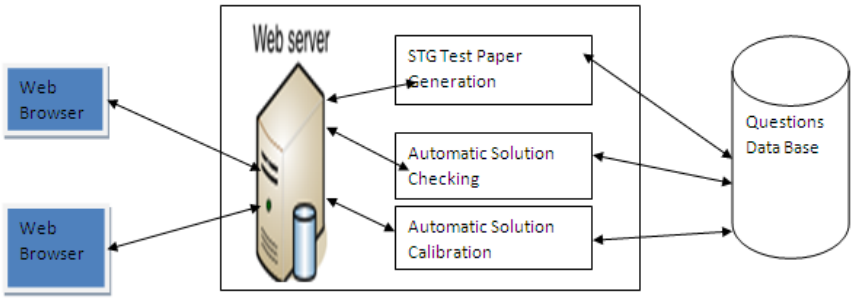

Fig. Web base Testing Framework

VI. CONCLUSIONS

The current approach could be extended to support the generation of multiple test papers simultaneously based on the same test paper specification. The quality of these generated test papers should be comparable. Therefore, to evaluate students in an online class, different test papers of equivalent or similar properties and quality can be used. Finally, the current system does not allow further changes on individual questions of a generated test paper after the test paper generation process. This could be enhanced by allowing admin to add and update individual questions of a generated test paper. As such, the web-based testing system will be more flexible in creating quality of test papers. We can also extend that after result published to the user they can check the answers what all the questions they made wrong and can check with the solutions given in the database.

REFERENCES

[1] C. Ramos, C. Frasson, and S. Ramachandran, "Introduction to the Special Issue on Real World Applications of Intelligent Tutoring. Systems," IEEE Trans. Learning Technologies, vol. 2, no. 2, pp. 62-63, Apr. 2009.
[2] P. Brusilovsky and P. Miller, "Web-Based Testing for Distance Education," Proc. World Conf. WWW and Internet (Web Net), vol. 99, pp. 24-30, 1999.58 IEEE TRANSACTIONS.
[3] R. Conejo, E. Guzma´n, E. Milla´n, M. Trella, J.L. Pe´rez-De-La-Cruz, and A. Rı´os, "SIETTE: A Web-Based Tool for Adaptive Testing," Int'l J. Artificial Intelligence in Education, vol. 14, no. 1, pp. 29-61, 2004.
[4] F.G. Martin, "Will Massive Open Online Courses Change How We Teach?" Comm. ACM, vol. 55, no. 8, pp. 26-28, http:// doi.acm.org/10.1145/2240236.2240246, Aug. 2012.
[5] K. Hopkins, Educational and Psychological Measurement and Evaluation. ERIC, 1998.
[6] T. Theunissen, "Binary Programming and Test Design," Psychometrika, vol. 50, no. 4, pp. 411-420, 1985.
[7] J. Adema and W. Vander Linden, "Algorithms for Computerized Test Construction Using Classical Item Parameters," J. Educational and Behavioral Statistics, vol. 14, no. 3, pp. 279-290, 1989.
[8] F.B. Baker and S.H. Kim, Item Response Theory. Marcel Dekker, 1992.
[9] P. Songmuang and M. Ueno, "Bees Algorithm for Construction of Multiple Test Forms in E-Testing," IEEE Trans. Learning Technologies, vol. 4, no. 3, pp. 209-221, July-Sept. 2011.
[10] J. Adema, E. Boekkooi-Timminga, and W. van der Linden, "Achievement Test Construction Using 0-1 Linear Programming," European J. Operational Research, vol. 55, no. 1, pp. 103-111, 1991.
[11] R. Fletcher, "A Review of Linear Programming and Its Application to the Assessment Tools for Teaching and Learning (as TTle) Projects," technical report, Massey Univ., 2000.
[12] T. Theunissen, "Some Applications of Optimization Algorithms in Test Design and Adaptive Testing," Applied Psychological Measurement, vol. 10, no. 4, pp. 381-389, 1986.
[13] R. Luecht, "Computer-Assisted Test Assembly Using Optimization Heuristics," Applied Psychological Measurement, vol. 22, no. 3, pp. 224-236, 1998.
[14] C.L. Lee, C.H. Huang, and C.J. Li, "Test-Sheet Composition Using Immune Algorithm for E-Learning Application," New Trends in Applied Artificial Intelligence, vol. 4570, pp. 823-833, 2007.
[15] T.F. Ho, P.Y. Yin, G.J. Hwang, S.J. Shyu, and Y.N. Yean, "Multi- Objective Parallel Test-Sheet Composition Using Enhanced Particle Swarm Optimization," J. Educational Technology Soc., vol. 12, no. 4, pp. 193-206, 2008.
[16] M.L. Nguyen, S.C. Hui, and A.C.M. Fong, "An Efficient Multi- Objective Optimization Approach for Online Test Paper Generation," Proc. IEEE Symp. Computational Intelligence in Multicriteria Decision-Making (MDCM), pp. 182-189, 2011.