DEVELOPING A FRAMEWORK FOR ONLINE PRACTICE EXAMINATION AND AUTOMATED SCORE GENERATION

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ABSTRACT

Examination is the process by which the ability and the quality of the examinees can be measured. It is necessary to ensure the quality of the examinees. Online examination system is the process by which the participants can appear at the examination irrespective of their locations by connecting to examination site via Internet using desktop computers, laptops or smart phones. Automated score generation is the process by which the answer scripts of the examinations are evaluated automatically to generate scores. Although, there are many existing online examination systems, the main drawback of these systems is that they cannot compute automated score accurately, especially from the text-based answers. Moreover, most of them are unilingual in nature. As a result, examinees can appear at the examination in a particular language. Considering this fact, in this paper, we present a framework that can take Multiple Choice Questions (MCQ) examinations and written examinations in two different languages English and Bangla. We develop a database where the questions and answers are stored. The questions from the database are displayed in the web page with answering options for the MCQ questions and text boxes for the written questions. For generating the scores of the written questions, we performed several types of analysis of the answers of the written questions. However, for generating the scores of the MCQ questions, we simply compared between the database answers and the user's answers. We conducted several experiments to check the accuracy of score generation by our system and found that our system can generate 100% accurate scores for MCQ questions and more than 90% accurate scores from text based questions.

KEYWORDS

Multiple choice questions, automated scoring, answer analysis, experimental analysis.

1. INTRODUCTION

Examination system is helpful to separate teaching and testing. It promotes teachers to make the lesson planning and teach in the class carefully. It is also an important mean of evaluating the teaching effect. Online practice examination systems can play an important role in the education system. Introduction of online examination systems can save time and money as well as it can justify ones capability. Though online examination it is not yet very popular in our country, it seems to be very useful for the students to take preparations for different examinations. Considering this fact, we have developed an online examination system, where students can appear different types of MCQ and written examinations and it is possible to generate automatic score when examination is taken. If one has computer with Internet connection, he / she can give the examination in real time and get the results of the examination instantly. He / she can even appear at the examination while moving using a laptop or a smart phone.

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The main objectives of our work are illustrated as follows:

- To develop a framework for online practice examination with automated score generation.
- To develop a user friendly interface for computers and smart phones so that the students can appear at the examination from easily.

The main contributions of this paper can be summarized as follows:

- We develop a system for online practice examination for the university entrance examinations.
- We develop a question database from which questions are generated dynamically.
- We evaluated answers to generate scores for both MCQ and written examinations.

The remainder of the paper is organized as follows. Section 2 provides a brief review of related works. Section 3 describes details about the architecture and methodology of our system. Section 4 gives the experimental results. Finally, we conclude the paper in Section 5. This document describes, and is written to conform to, author guidelines for the journals of AIRCC series. It is prepared in Microsoft Word as a .doc document. Although other means of preparation are acceptable, final, camera-ready versions must conform to this layout. Microsoft Word terminology is used where appropriate in this document. Although formatting instructions may often appear daunting, the simplest approach is to use this template and insert headings and text into it as appropriate.

2. RELATED WORK

Web-based examination system (Fang et al. , 2012) provides the functionality of question management, paper generation and online tests.

two models are designed to develop a system by which online examination can be held. Here how a teacher set a question paper and then test would hold by online. But no automated scoring is possible. In 1966, Ellis Page showed that an automated “rater” is indistinguishable from human raters [2].

Latent semantic analysis (LSA) is a technique in natural language processing, in particular in vectorial semantics, of analyzing relationships between a set of documents and the terms they contain by producing a set of concepts related to the documents and terms. LSA assumes that words that are close in meaning will occur in similar pieces of text. A matrix containing word counts per paragraph (rows represent unique words and columns represent each paragraph) is constructed from a large piece of text and a mathematical technique called singular value decomposition (SVD) is used to reduce the number of rows while preserving the similarity structure among columns [3], [9]. Page developed PEG the first attempt at scoring essays by computer. Page uses the terms trins and proxes for grading an essay; trins refer to the intrinsic variables such as fluency, diction, grammar, punctuation, etc., proxes denote the approximation (correlation) of the intrinsic variables.

IntelliMetric [4] uses a blend of Artificial Intelligence (AI), Natural Language Processing (NLP), and statistical technologies. Search is a system specifically developed for use with IntelliMetric to understand natural language to support essay scoring. IntelliMetric needs to be “trained” with a set of essays that have been scored beforehand including “known scores” determined by human expert raters.

The various AES programs differ in what specific surface features they measure, how many essays are required in the training set, and most significantly in the mathematical modeling technique. Early attempts used linear regression. Modern systems may use linear regression or other machine learning techniques often in combination with other statistical techniques such as Linear Semantic Analysis and Bayesian inference [5].

There are many limitations in the above related works. Most of the automated score is done on the basis of English literature and essay score. There are some few works on the automated score for the online examination for mathematics and physics. It is challenging to score the answer script automated for more than one subjects.

3. System Design And Implementation

The online practice examination system is a client server model. In the system, web browser is used as client, JSP Engine as the business logic tier to achieve its function, and database system as the data layer. Client is web browser, which is implemented the system's display logic. The function sent request to Web Server through the Web browser by users.

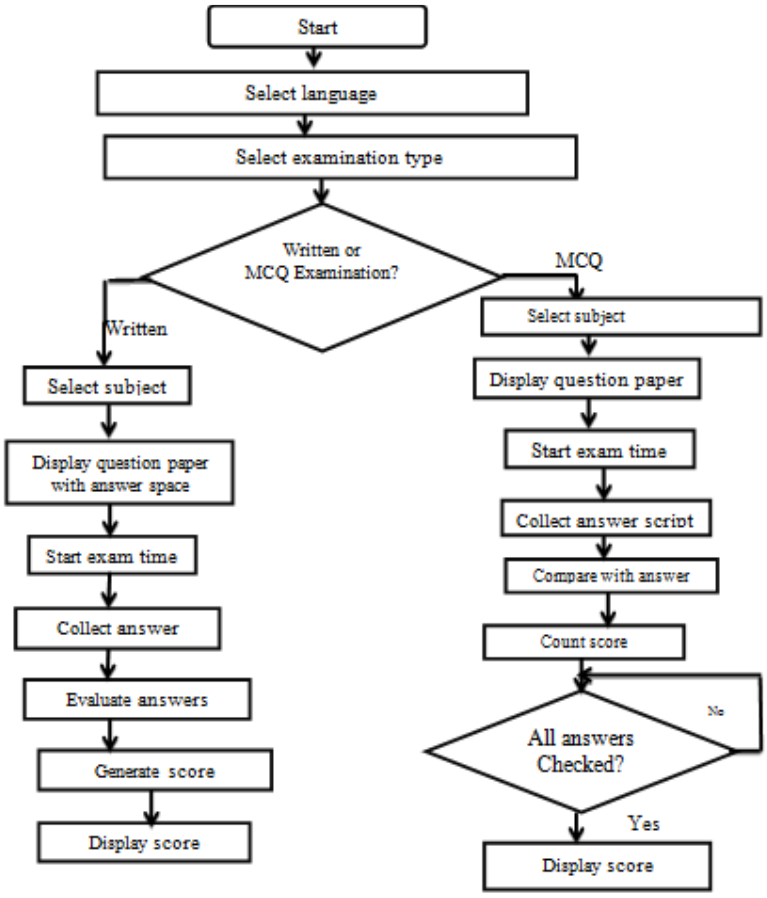

Figure 1: Flow diagram of the system

While Web Server return the requested HTML pages or HTML pages dynamically generate by JSP page to the client, which are shown in the Web browser. Business logic tier is achieved

mainly by JSP and Java Bean running in the JSP Engine. It responds to client requests and achieved the business logic with the Web Server. Tomcat, open source software is used as the JSP Engine and Web Server. Data tier is realized with database system, is used to store the business data such as questions and papers and control data such as user data. MS ACCESS is used to achieve the data tier. The flow graph of the proposed method is given in Figure 1.

The user enters to the system from the URL: bdadmissionexam.com and selects the type of the examination. When the user selects the admission type, he will route into another web page. If he/she selects the University or Medical option he/she can answer only MCQ type questions. If he/she selects the Engineering option he/she will get both MCQ and written questions. Figure 2 shows the procedure for the selection of examination type.

```
Algorithm select_Admission_Type Method: POST
action='route.php'
1. switch select from name="sub"
2. case "eng":Engineering
3. case "uni":University
4. case "med":Medical
</select>
<input type='submit' name='submit'>
```

Figure 2**:** Procedure for selection of examination type

In both written and MCQ type questions, the users can select selective type of subjects to participate in the practice exam. In case of university type, the subjects are Physics, Chemistry, Mathematics, English and Biology. In case of Engineering type, the subjects for both written and MCQ questions are Physics, Chemistry, Mathematics and English. In case of Medical type the subjects are Biology, Physics, Chemistry and English. Figure 3 shows the code segment for subject selection.

```
Algorithm: MCQ_Exam

Method=POST

//Select Any Subject:

1. switch select from name="sub"

2. case "biology":Biology

3. case "chem":Chemistry

4. case "english":English
```

Figure 3: Procedure for selection of subject

When the user selects a subject for a particular type then a question paper is displayed on the web page. The question generation is changeable i.e. question once appeared first time may or may not be in the second or other time. The database for the questions of different subjects is created with the appropriate answer of the questions. The database is created by MySQL and PHP is used to

generate the question for the students. An answering block will be there for the written questions. For the MCQ questions the four options will displayed with radio button. Only one option can select which should be the correct answer. Algorithm in Figure 4 performs the task.

```
Algorithm: Displayig_question

1. while  found until row =
mysqli_fetch_array(result)

2. show iteration."."row['question']

3. put id=row['id']

4. put a1=$row['a1']

5. put a2=row['a2']

6.put a3=row['a3']
```

Figure 4: Procedure for MCQ question pattern

When the question paper is displaying then a timer is set for each subject and when the time is finished the question paper will submit automatically. If the students want to submit the answer before time then he/she will select the answer button. Programming language Ajax is used to count time during the examination. The algorithm is shown in Figure 5.

```
Algorithm: Start_Time

function Decrement() {

 1. initiate currentMinutes = Math.floor(secs / 60);

 2. initiate currentSeconds = secs % 60;

 3. if currentSeconds less than or equal 9

 4. do currentSeconds = "0" + currentSeconds;
```

Figure 5: Procedure for timer control

When the user finishes the examination he/she will select the answer button or it will automatically submit after the time finishes. Then it is ready to score. The answer collect from the user is compare with the answer from the database. We use similar-text algorithm for comparing written examination. This calculates the similarity between two strings as described in Programming Classics: Implementing the World's Best Algorithms by Oliver. Note that this implementation does not use a stack as in Oliver's pseudo code, but recursive calls which may or may not speed up the whole process.

As the users attend the examination they will want to see the result of the examination very quickly. This procedure is shown in Figure 6.

```
Algorithm: Evaluate_Answer
1. while  found until row =
mysqli_fetch_array(result){
2. initiate ans=row['answer'];
3. val;
4. similar_text(ans, val, p);
5. put p=(p/10);
}
```

Figure 6: Procedure answer evaluation

But before displaying the result the score will be generated and counted. After the comparing the user answer with the appropriate answer in the database the score is generated. The following algorithm is required to generate score of the examination.

```
Algorithm: Generate_Score
1. For each POST as keys=>val
2. keys;
3. val;
4. Givemark ($keys,$val,$sub);
5. endfor
```

Figure 7**:** Procedure for score generation of MCQ type questions

Generation of score for MCQ type is entirely different from the written type. The answer will compare with the answer database and the correct answers will count and add with the total score. The following algorithm is used to count score of written questions.

```
Algorithm: Count_Score

function givemark(keys,val,sub){

1. input: keys, val,sub

2. result = mysqli_query(con,"SELECT * FROM
sub where id='keys' AND answer LIKE '%val%'");

3. rowcount=mysqli_num_rows(result);

4. rowcount;

5. if $rowcount greater than 0

6. Increment GLOBALS['mark']

7. endif}
```

Figure 8: Procedure for score generation of written type questions

4. EXPERIMENTS

The experimental result based on some examinations given by some of the CUET students. They attended the examinations which were graded by our system. The same answers were scored manually. Then the deviation of the automated score and the human score were computed and the accuracy of the developed system were measured.

In order to take the examination, five students from different halls of a public university were chosen. We considered five different question sets for each subject and assigned a separate question set to each of the five students. Each answer script of written type examination was scored by our developed system and by a human expert. Then, we compared human score and automated score as shown in Figure 9 to Figure 12 for different subjects.

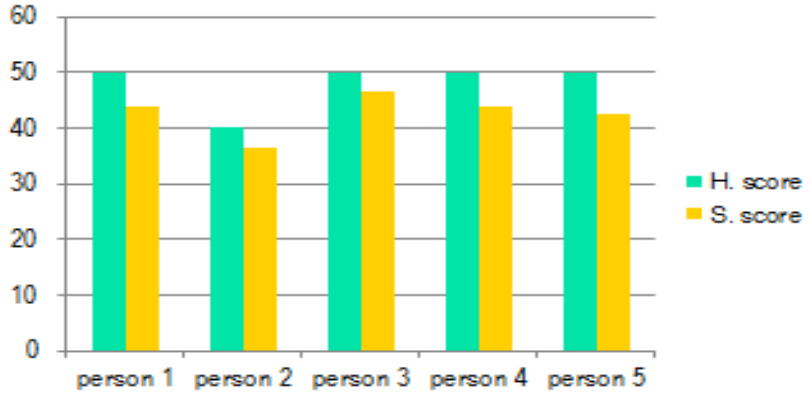

Figure 9**:** Human & system score for physics

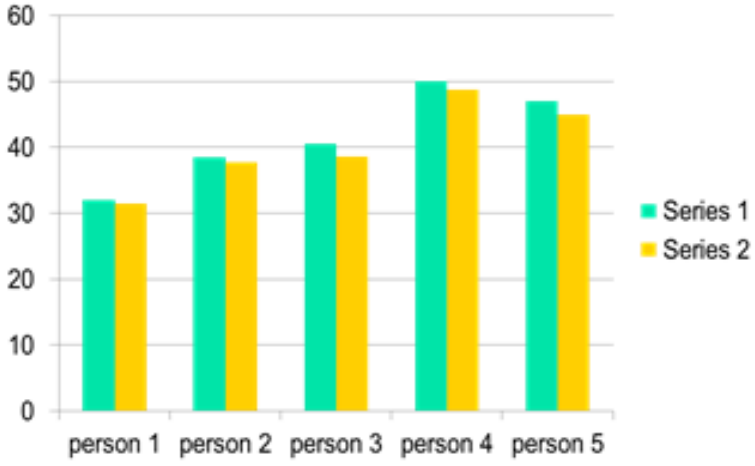

Figure 10: Human & system score for chemistry

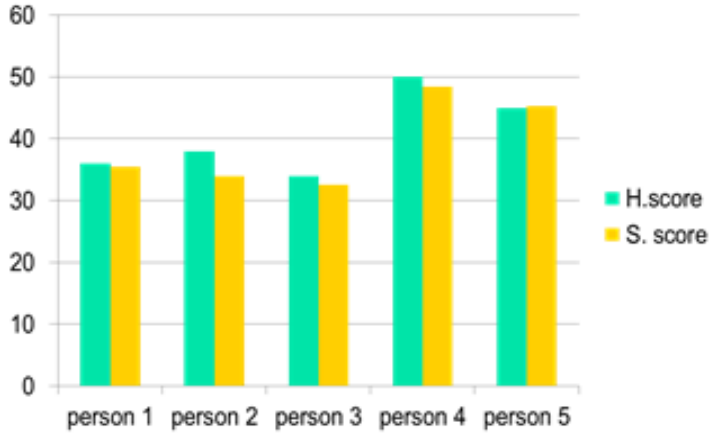

Figure 11**:** Human & system score for mathematics

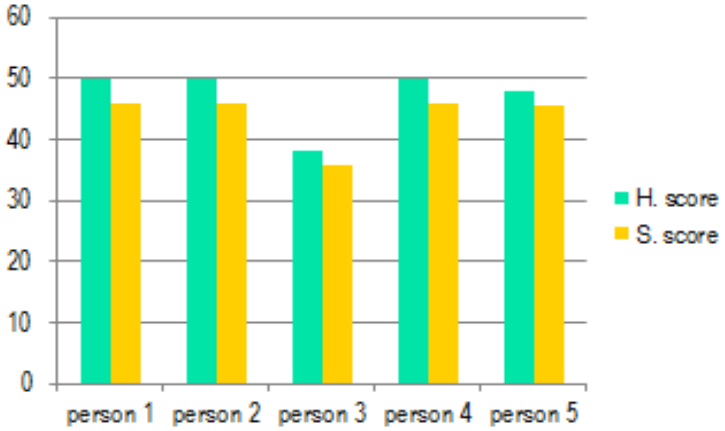

Figure 12**:** Human & system score for English

5. CONCLUSION

Online practice examination and automated score will help the students to prepare themselves for the admission examination in different universities. By this system the students can prepare themselves while staying in their houses as well as while they are moving with their laptops and smart phones. As the system is capable of generating automated score so the students will find themselves beneficial. We tested our system against human generated score and found that our system is an efficient one.

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