

Advanced Question Paper Generator Implemented Using Fuzzy Logic

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Abstract - Examination is necessity of determining the quality of a candidate's knowledge at each level. It helps to test the expertise and skills of the students in any field. Hence, conducting exam at each level may lead to some difficulties or issues such as time and other resources while creating the test papers manually. So a system would make the task simpler which generates test paper automatically. Advance Question paper generator system is implemented by keeping in mind such difficulties, which can generate paper easily. The system is based on the concept of fuzzy logic which helps in generating question paper each time with user defined difficulty level. Paper can be generated at any time. We have make use of random function so that unique paper get generated every time. Security is also maintained. System is developed using Microsoft visual studio2015 and MS SQL server 2014.

Key Words: Fuzzy Logic, Analytical, Descriptive, Fuzzification, Defuzzification

1 INTRODUCTION

Education is one of the important parts of our life. There are several ways by which can gain the knowledge but at the early stages of life, teacher plays very important role. Even if want to gain the knowledge through other sources like books, research articles, internet videos, some preliminary knowledge is always required to understand or to get knowledge through these resources. After getting the knowledge it is always required to test how much capability one has to apply the knowledge to solve the relevant problems. In the test or examination various kinds of questions are included. Some of them are known to the students while some are unknown but relevant to the concepts they have studied. In almost all the colleges or universities paper level is decided according the previous years' students' performance. Due to which we can have several question paper levels like easy, medium, hard etc. In most of the reputed universities professors are generally busy in doing some research work besides the

academic work. Hence they generally do not want to spend much time in question paper setting and generation. So they need automatic question paper generator which will fetch the questions from the database which is developed by contribution of all the professors of the respective subject. In this system we have flexibility for the professors to choose the subjects while registration or admin can add professor's details and allocate subjects to him. One professor can work with maximum four subjects. He can add, delete or update the questions. Particular question will be deleted from database permanently if all the professors of that subject are agree for the deletion of that question. We also have difficulty level for question paper generation. To decide the difficulty level of a particular question, we have two parameters, Analytical_quotient and Descriptive_quotient. These quotients are stored as attributes of the question in the database table. Analytical_quotient defines how much thinking or imagination needed to solve the question. Numerical and logical types of questions are generally highly analytical whereas theoretical questions are fall into Descriptive type. If question is highly analytical, it tends to difficult level whereas descriptive questions are generally tends to easy or medium level. Actual level of the question is decided using both analytical and descriptive quotients. We get the level after doing certain fuzzy computations. In the nature, different people have different perspective to look at the various things. One may feel particular question difficult while other may feel it easy. This is the reason for applying fuzzy logic. Fuzzy logic is based on imprecision or approximation. For an integer we can definitely say that whether it is positive or negative. But in case of difficulty level of the question we can't categorize the question in a particular set with hundred percent membership value to that set. Hence we have taken the help of fuzzy logic to solve this problem. The system is flexible and easy to use. At the end question paper will be generated in the text file format which enables the professor to edit the questions. System is secure and paper can be generated even before few

minutes of the examination which helps to avoid any paper leakage. System works perfectly if we have enough number of questions in the database. System can be even incorporated as client server model with the database deployed on a one server or a node.

2 LITERATURE REVIEW

We have done survey of existing papers and found following information:

In the first paper, Apriori algorithm and fuzzy logic is used. In this system login module has ability to differentiate between admin and staff people. Admin has rights to fill all the information about and he is also responsible for giving them various access rights. System supports all the possible operations like question insertion, modification and deletion. System uses "TOP N" query approach which returns the topmost rows and puts the limitation on number of rows returned. Apriori algorithm belongs to Big Data Analytics which gives importance to frequently occurring elements. In this system paper is generated according to user defined level and get stored in text format. In the Apriori algorithm, large sets of questions' are analyzed. So it results in large number of computations. [2]

In the second paper, question paper generation is based on fuzzy logic. They have divided this process into three stages. In the system all users put analytical index (A) and descriptive index (D) for the particular question. Process is divided into three stages. In the first phase, four users put values for descriptive, analytical, easy, medium and difficult parameters. Values can be anything between 1 and 10 for A and D parameters. Floating point values are also allowed. Easy and difficult values are between 1 and 5 whereas range for medium is 1 to 10. In the second phase, system generates the skeleton based on user inputs. Every time new skeleton is generated. Using some interface users are allowed to put the questions into the skeleton generated. In the third phase, question bank is generated according to questions submitted by all the users and final paper is generated. System is flexible because number of users and skeletons can be dynamically changed. System proposes MATLAB for fuzzy logic computation. [3]

In this System question paper generated is of type multiple choice questions. Fuzzy logic and ant's colony are two famous techniques used in the system. In this system admin can enter the various questions into database table and their respective options. Admin has rights to provide complexity level and marks for each questions. In this admin chooses difficulty level of the paper (which can be easy, medium or tough) and generates question paper. After generation of question paper's pdf file, System makes email to the appropriate college. This method is mainly applicable and useful for competitive exams. [4]

3 PROBLEM STATEMENT

3.1 Inputs: After login using ID and password, GUI will be displayed saying paper pattern choices and difficulty level. There are three paper patterns and five difficulty levels. User needs to choose any one pattern and any one difficulty level.

3.2 Output: Question paper in the pdf format will be generated

4 FUNCTIONS OF THE SYSTEM

4.1 Authentication and authorization process:

4.1.1: User will make registration by submitting his personal information in the form designed GUI. While registration user puts his personal information like name, sex, phone, email and any four subjects that he want to work with. However admin has rights to change or allocate different subjects to the user. Also admin can edit information of all users in the system. This software will generally be owned by educational institutes and user will be some college professor.

4.1.2: After submitting the registration form, Message will be displayed: You will be able to login after verification of credentials by admin.

4.1.3: Admin is person who can actually see and handle the database. We have one column in a registration table as 'Admin_verified'. Admin enters 'yes' or 'no' for a particular

user or can delete his/her entry from the database. Admin can edit the personal information of the user. He can also manipulate the subjects' database.

4.1.4: Any user's login will be successful if and only if he is admin verified ; that is if his/her entry under the column 'Admin_verified' is 'yes'

4.2 Question Fetching stage:

4.2.1: After successful login user will be allowed to choose the subject for which he want to fetch questions or generate the paper. At a time he can choose only one subject and work with it. But he can again go back and work with other subjects allocated to him.

4.2.2: User must select type of paper and difficulty level.

4.2.3: After clicking on 'Fetch questions', all questions will be displayed on the user's GUI in the grid view. In that he can see Analytical_quotient of the question, Descriptive_quotient of the question, Marks, Whether that is included or not while paper generation. ('1' for included, '0' for not included)

4.3 Paper Generation:

4.3.1: After clicking on 'Generate paper' paper will be generated and stored into text file.

4.3.2: User can also edit the text file and can change the questions.

4.3.3: Due to the use of 'Random function', the question paper generated will be unique every time.

4.4 Question insertion:

4.4.1: Like the paper generation, a separate GUI will be provided for question insertion.

4.4.2: User must enter Question, its Analytical_quotient, Descriptive_quotient and Marks.

4.4.3: Before insertion user can see all the questions in the database, so that duplication is avoided. Separate button is provided to see all the questions.

4.5 Question parameters modification

4.5.1: User can also modify Analytical_quotient, Descriptive_quotient of the question. Average of previously

existing quotients and user entered quotients will be stored into database.

4.5.2: The reason for storing average of these parameters is we want to take every user's view into consideration for that question.

4.6 Question deletion

4.6.1: User can also delete the outdated questions. However after pressing the delete button for the particular question, question is not deleted immediately. It will wait until the arrival of all users' response for that question.

4.6.2: We have one column named as deletion in the table of every subject's database. When particular user deletes the question then deletion count for that question in the appropriate subject's table get incremented by one. Also the entry in the log is made so that this user should not be able to increment the deletion count for a particular question more than ones.

4.6.3: After agreement of all users for the particular question for deletion, question will be deleted from the database permanently.

5 FUZZY LOGIC ALGORITHM

1. Start
2. Decide the subject and maximum marks.
3. Repeat the steps 4 to 19 for each question.
4. For the particular question in a database, read analytical_quotient and Descriptive_quotient.
5. Store these values into variables x and y such that $x = \text{analytical_quotient}$, $y = \text{Descriptive_quotient}$.
6. Find the range of 'x' from fuzzy graph or fuzzy equations. These are nothing but equations in a fuzzification stage.
7. Calculate 'u' values ('u' is membership value of input variable to the particular set) for x. Each range has one or two membership equations.
8. Repeat the steps 6 and 7 for 'y' values also.
9. We can get one or two of 'u' values for x. same for the 'y'.
10. Thus we can form total one, two or four groups depending upon number of 'u' values that we got for 'x' and 'y' in the previous stages. Each group can contain only two 'u' values, one for 'x' and one for 'y'. We consider all possible groups (example: If we get 2 'u' values for 'x' and 2 for 'y' then groups formed are (ux1, uy1), (ux1, uy2), (ux2, uy1), (ux2, uy2))

11. After forming all the groups of size two, take minimum value from each group. Thus every group now contains only one 'u' value either 'ux' or 'uy'.

12. Take maximum value among the values we got in the step 11.

13. This particular value obtained in previous step corresponds to a specific group among the groups formed in step 10.

14. Take ux and uy values of that group. These 'u' values corresponds to a particular rule in fuzzy rule base.(Example: IF high analytical_quotient and medium Descriptive_quotient THEN difficult)

15. Using appropriate fuzzy rule we get THEN part, that is question level. or range(particular range or ranges in fuzzy output equations)

16. Like input equations, we also have fuzzy output membership equation. So by seeing appropriate range(depending on value got in step 15) and applying corresponding output equation, we get question level in the defuzzified form.

17. Repeat step 16 for each range if any.

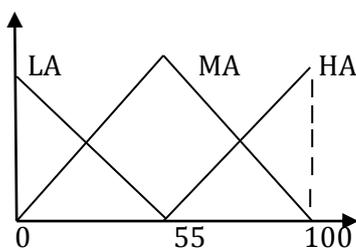
18. Take average of all defuzzified values. This value will actually decide the level of the question.

19. If level selected by the user equals to the level got in previous step question will be marked as '1'(can include) otherwise '0'(cannot include).

20. Stop after visiting all the questions.

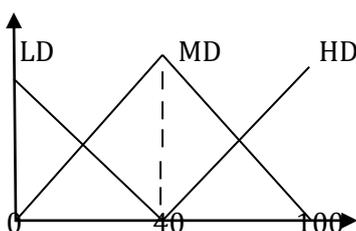
6 FUZZY EQUATIONS

6.1: Membership Function For Analytical variable



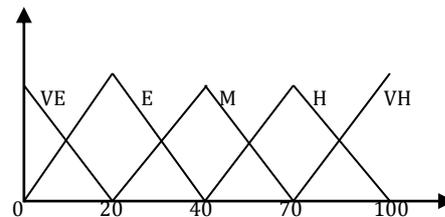
$$\begin{aligned} u_{LA} &= (55-x)/55 & 0 \leq x \leq 55 \\ u_{MA} &= x/55 & 0 \leq x \leq 55 \\ &= (100-x)/45 & 55 \leq x \leq 100 \\ u_{HA} &= (x-55)/45 & 55 \leq x \leq 100 \end{aligned}$$

6.2: Membership Function For 'Descriptive' variable



$$\begin{aligned} u_{LD} &= (40-y)/40 & 0 \leq y \leq 40 \\ u_{MD} &= y/40 & 0 \leq y \leq 40 \\ &= (100-y)/60 & 40 \leq y \leq 100 \\ u_{HD} &= (y-40)/60 & 40 \leq y \leq 100 \end{aligned}$$

6.3: Output Membership Function (To decide question level)



$$u_{VE} : (20-z)/20 = m \quad 0 \leq z \leq 20$$

$$u_E : \begin{cases} z/20 = m1 & 0 \leq z \leq 20 \\ (40-z)/20 = m2 & 20 \leq z \leq 40 \end{cases}$$

$$u_M : \begin{cases} (z-20)/20 = m1 & 20 \leq z \leq 40 \\ (70-z)/30 = m2 & 40 \leq z \leq 70 \end{cases}$$

$$u_H : \begin{cases} (z-40)/30 = m1 & 40 \leq z \leq 70 \\ (100-z)/30 = m2 & 70 \leq z \leq 100 \end{cases}$$

$$u_{VH} : (z-70)/30 = m \quad 70 \leq z \leq 100$$

Where

LA: Less Analytical
MA: Medium Analytical
HA: Highly Analytical

LD: Less Descriptive
MD: Medium Descriptive
HD: Highly Descriptive

VE: Very Easy E: Easy
M: Medium D: Difficult
VD: Very Difficult

6.4: Fuzzy Rule Base

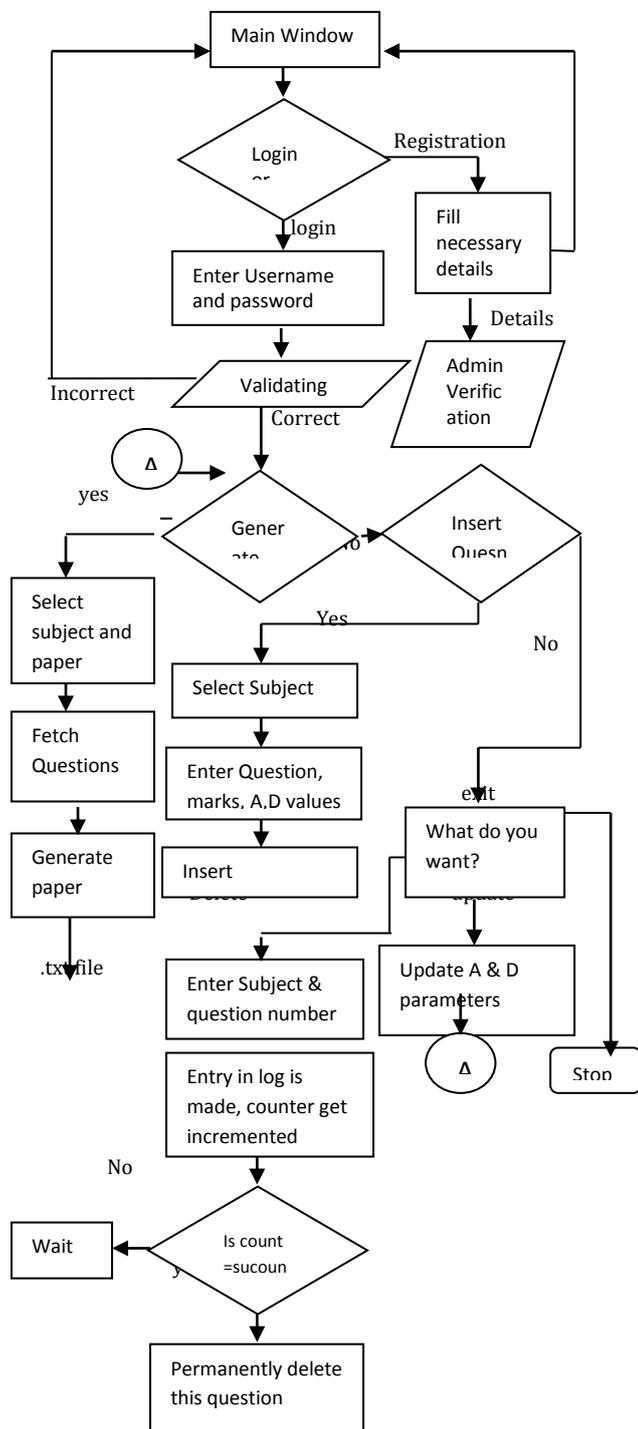
	A			
D		LA	MA	HA
LD	VE	M	VD	
MD	E	D	VD	
HD	M	D	VD	

Where all the above entries have meanings mentioned in 6.3

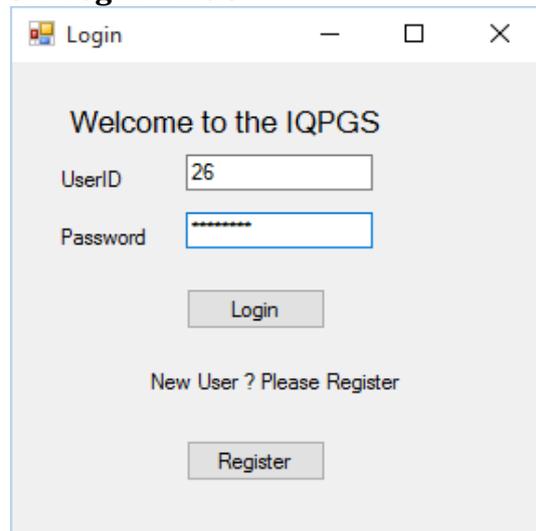
There are total 9 fuzzy IF-THEN Rules

example: IF A is Highly Analytical AND D is Less Descriptive THEN output level is Very Difficult.

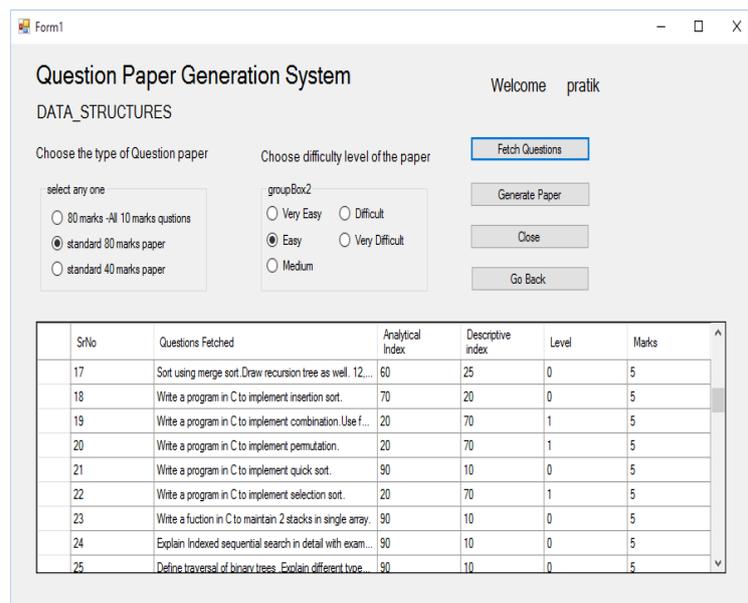
7 SYSTEM FLOW



8.1 Login window



8.2 Generate paper



8.3 Final Paper

Final paper is displayed in the text file format which includes subject name and maximum marks.

8 IMPLEMENTATION

Some implementation screenshots are presented below

```
name - Notepad
File Edit Format View Help
SUBJECT: DATA_STRUCTURES
TOTAL MARKS: 80
1) What is B+ tree. Insert following numbers in B+ tree.
1,56,23,65,73,33,98,100,43,22,45,15,18,2,9,48,94. Order of the tree is 5. (10)
2) Define ADT. Write ADT to count even numbers in a stack. (10)
3) Write a program in C to delete a node from BST. The program should consider all
possible cases. (10)
4) Write a program to count primary numbers in the linked list. Use necessary
functions. (10)
5) What are queues? Write C function to implement 2 types of priority queues (10)
6) Explain concept of B tree. Insert following numbers in B tree 10, 40
,23,5,213,54,53,1,66,78,334,2. Order of the tree is 5. Show tree diagram (10)
7) Write a C function to delete a particular node after the given node (e.g: delete
after 25). If given node is absent then show proper message (10)
8) What do you mean by Sparse matrix? How Sparse matrix can be implemented using
linked list. (10)
```

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9 CONCLUSIONS

With this paper we present an 'Advanced Question paper Generator' implemented using fuzzy logic. The System is easy to use and it generates the question paper in very few seconds according to inputs given by the user of system.

Paper generated is in the text format; due to this user can make changes if required. This system is dynamic and it supports all necessary operations like questions insertion, parameters modification as well as questions deletion. Functionalities such as login and registration make the system much secure and admin of the system has necessary and important rights such as user modification, insertion and deletion. This System is able to generate paper on the examination day within a few seconds so that any paper leakage is avoided.

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