"Blooms Taxonomy Based Question Paper Generation Using Machine Learning Algorithms"

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Abstract: Exams are a key part of education, helping to test what students know and can do. However, making question papers the traditional way can be a tiring an\\d time-consuming task for teachers. It's not always easy to balance the difficulty of the questions and make sure they cover all the important topics in the curriculum. This can sometimes lead to mistakes or uneven question papers.

With technology improving quickly, there is now a need for better ways to create exam papers that save time and still maintain high quality. One of the big challenges in this process is ensuring that questions cover different thinking levels, as explained in Bloom's Taxonomy. This framework organizes learning into categories like remembering, understanding, applying, and analyzing.

This project introduces an automated system to make creating question papers faster and easier. Using machine learning, the system can generate questions that match Bloom's Taxonomy and create well-balanced papers. These papers are customized to meet the needs of the subject and the educational goals of the institution.

To make the process even smoother, the system can produce the question papers as PDFs. This makes it simple for teachers to review, share, and store them. Automation reduces the chances of errors and gives teachers more time to focus on teaching and helping students.

In short, this project uses smart technology to simplify exam paper creation. It ensures that question papers are fair, high-quality, and aligned with educational goals, making life easier for teachers and improving the learning experience for students.

Key Words: Question paper generation, educational technology, machine learning, assessment processes, PDF format, educational institutions, government exams

INTRODUCTION

Examinations are an important part of education, helping to assess students' knowledge and skills. However, creating question papers manually can be a challenging and time-consuming job for teachers. It often leads to errors and inconsistencies, making it difficult to ensure high-quality assessments.

This project offers a solution to simplify and automate the process of creating question papers. Using machine learning and Bloom's Taxonomy, the system ensures that

the questions are well-structured and meet educational standards. It also includes a feature to generate question papers in PDF format, making it easier for examiners to access and use them.

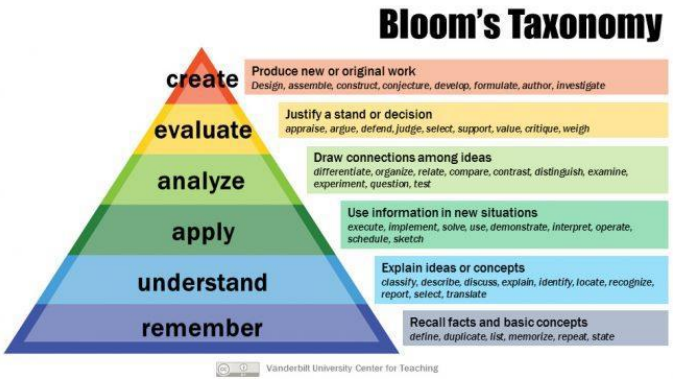


Fig [1] blooms Taxonomy levels

Background of the Industry:
Question papers are essential tools for testing students' understanding and abilities. However, manually preparing these papers is a tedious and error-prone task. It can result in repeated questions and affect the fairness of the exams.

This project addresses these problems by introducing an automated system that generates question papers accurately and efficiently. It ensures that the questions align with educational goals. Additionally, the option to email the papers to examiners makes the process more modern and convenient.

Proposed Working

The proposed system is designed to predict marks and Bloom's Taxonomy levels by leveraging datasets and employing linear regression and random forest algorithms. It also allows for the creation of datasets for various subjects and the generation of question papers at different difficulty levels. Below is a step-by-step overview of the process:

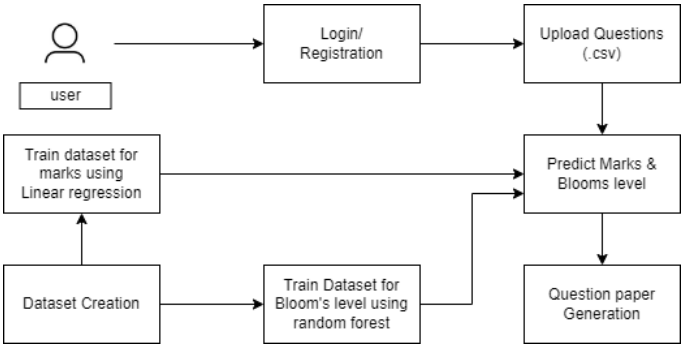


Fig [2] System Architecture

1. Login/Registration

Users can either sign into the system with existing credentials or create a new account to access its features.

2. Upload Questions (.CSV)

Users can upload question papers in CSV format. The uploaded file should include the questions, their answers, and the corresponding Bloom's Taxonomy level for each question.

3. Dataset Creation

The system processes the uploaded questions and generates a dataset. This dataset is utilized to train machine learning models for further functionality.

4. Train Dataset for Marks Prediction using Linear Regression

The system divides the dataset into training and testing sets. The training set is used to develop a linear regression model that predicts the marks associated with each question, while the testing set evaluates the model's accuracy.

5. Train Dataset for Bloom's Level Prediction using Random Forest

Similarly, the dataset is split into training and testing sets. The training set is used to build a random forest model that predicts the Bloom's level for each question, and the testing set assesses the model's performance.

6. Question Paper Generation

After the models are trained, they are utilized to generate new question papers. The linear regression model determines the marks for each question, and the random

forest model categorizes the Bloom's level, ensuring well-structured question papers.

7. Result

The automation of manual question paper generation has resulted in an efficient, reliable, and user-friendly system. This system can produce diverse and unique question papers with minimal human input, significantly saving time and effort for educators and administrators. It reduces the risk of errors and ensures fair and accurate assessments.

The system also offers customizable difficulty levels, uses Bloom's Taxonomy for organizing questions, and supports various formats for easy sharing and administration. Overall, it provides an optimized and enhanced approach to generating question papers, improving the educational assessment process.

Methodolgy

The Bloom's Taxonomy-Based Question Paper Generation System Using Machine Learning Algorithms follows a structured approach to automate and optimize the process of question paper creation. The methodology consists of several key stages:

1. Data Collection and Preprocessing:

A database of questions is gathered from various sources, ensuring a diverse and comprehensive question bank. Each question is labeled according to Bloom's Taxonomy, categorizing them into cognitive levels such as Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation.Text preprocessing techniques, including tokenization, stop-word removal, and stemming, are applied to standardize the dataset.

2. Feature Extraction and Classification:

Natural Language Processing (NLP) techniques are used to extract key features from the questions. A machine learning model, such as Random Forest, is trained to classify questions into appropriate Bloom's levels based on their complexity and structure.

3. Automated Question Selection:

Educators provide input parameters such as subject, difficulty level, and the distribution of questions across Bloom's Taxonomy.The system dynamically selects questions from the database, ensuring a balanced assessment with varied cognitive levels.

4. Question Paper Generation:

The selected questions are compiled into a structured format, ensuring diversity and non-redundancy.The system generates a PDF file containing the question paper, which can be reviewed and modified by educators if needed.

5. Evaluation and Optimization:

Feedback mechanisms allow educators to refine the system by adjusting classification accuracy and question selection.The system improves over time by retraining the model with updated data and educator inputs.

This methodology ensures that the generated question papers are balanced, accurate, and aligned with educational objectives, making the assessment process more effective and streamlined.

Tools and Technologies Used

The system employs a variety of tools and technologies to facilitate efficient question paper generation:

1) Programming Languages: Python (Backend), HTML, CSS, JavaScript (Frontend)

2) Frameworks: Django (Backend), Bootstrap (Frontend UI Styling)

3) Database Management System: SQLite for structured data storage

4) Machine Learning Libraries: scikit-learn (Random Forest, Linear Regression), Pandas for data handling

5) Development Tools: Visual Studio Code, GitHub for version control

Results

Fig [2] Dashboard

The Question Paper Generator Software is a professional tool for educators and exam organizers to create customized assessments efficiently. With a clean, scholarly interface, it offers user accounts, templates, and streamlined question paper generation.

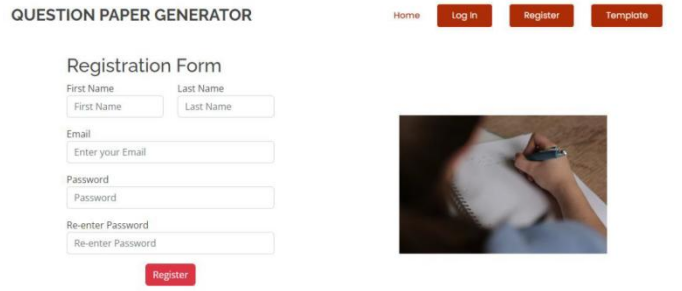


Fig [3] Registration page

The registration page enables users to create accounts with essential details like name, email, and password. It features a clean design, validation checks for security, and a seamless user experience. Upon successful registration, users receive a confirmation and are redirected to the login page.

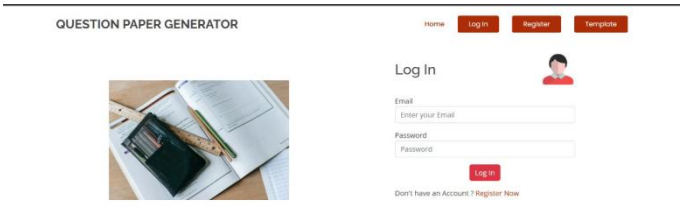


Fig [4] Login page

The login page provides a secure, user-friendly entry for registered users. It features email and password fields, ensuring easy access while maintaining security. A "Register Now" option guides new users to sign up. The streamlined design enhances accessibility and trust in the platform.

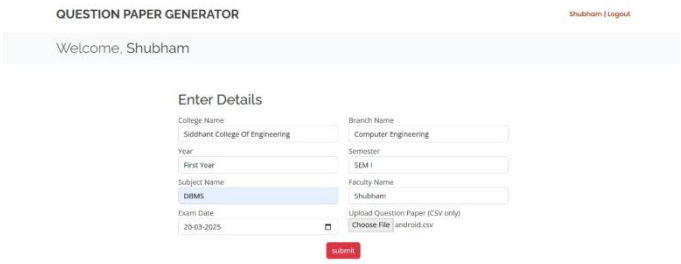
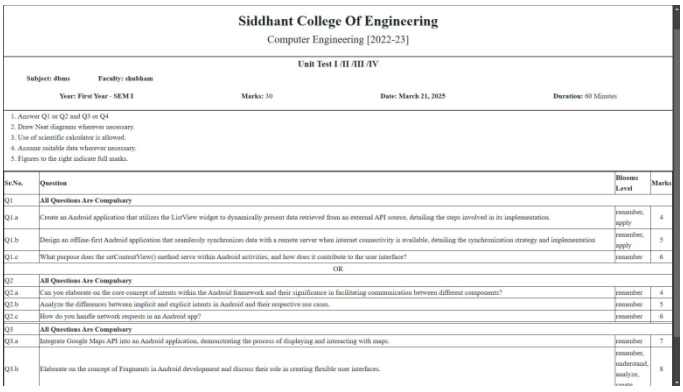


Fig [5] Generate Question Paper Page

The question paper generation page offers a structured, user-friendly interface for educators to create customized exams. Dropdowns for college, branch, year, and semester ensure tailored question papers, while input fields capture subject and faculty details. A calendar tool simplifies exam date selection, and a CSV upload option allows easy question integration. This streamlined design enhances efficiency and customization.



Siddhant College Of Engineering

Computer Engineering [2022-23]

Unit Test I /II /III /IV

Subject: dbms **Faculty:** shubham

Year: First Year - SEM I **Marks:** 30 **Date:** March 21, 2025 **Duration:** 60 Minutes

1. Answer Q1 or Q2 and Q3 or Q4
2. Draw Neat diagrams wherever necessary.
3. Use of scientific calculator is allowed.
4. Assume suitable data wherever necessary.
5. Figures to the right indicate full marks.

Sr.No.	Question	Blooms Level	Marks
Q1	**All Questions Are Compulsory**		
Q1.a	Create an Android application that utilizes the ListView widget to dynamically present data retrieved from an external API source, detailing the steps involved in its implementation.	remember, apply	4
Q1.b	Design an offline-first Android application that seamlessly synchronizes data with a remote server when internet connectivity is available, detailing the synchronization strategy and implementation	remember, apply	5
Q1.c	What purpose does the setContentView() method serve within Android activities, and how does it contribute to the user interface?	remember	6
	OR		
Q2	**All Questions Are Compulsory**		
Q2.a	Can you elaborate on the core concept of intents within the Android framework and their significance in facilitating communication between different components?	remember	4
Q2.b	Analyze the differences between implicit and explicit intents in Android and their respective use cases.	remember	5
Q2.c	How do you handle network requests in an Android app?	remember	6
Q3	**All Questions Are Compulsory**		
Q3.a	Integrate Google Maps API into an Android application, demonstrating the process of displaying and interacting with maps.	remember	7
Q3.b	Elaborate on the concept of Fragments in Android development and discuss their role in creating flexible user interfaces.	remember, understand, analyze,	8

Fig [6] Final Result

The final screenshot highlights the system's ability to automate question paper generation based on user selections. It offers customization options for format, layout, font, and question distribution, ensuring adaptability to various educational needs. The system also supports flexible mark allocation, aligning assessments with different curricula. By automating and

streamlining the process, it saves educators time while maintaining assessment quality.

Objectives

The goal of this project is to create an automated system for generating question papers using machine learning algorithms and Bloom's Taxonomy. The system is designed to improve the efficiency, accuracy, and quality of the examination process by achieving the following objectives:

1. Automation of Question Paper Generation: This system automates the traditionally manual process of creating question papers, reducing educators' workload while maintaining the quality and relevance of questions.

2. Incorporation of Bloom's Taxonomy for Balanced Assessment: By incorporating Bloom's Taxonomy, the system ensures that questions cover a spectrum of cognitive levels, ranging from basic knowledge recall to higher-order skills like analysis, synthesis, and evaluation. This supports a well-rounded and educationally sound assessment structure.

3. Reduction of Human Error: The automated approach helps eliminate common errors such as question repetition, misalignment with learning outcomes, and inconsistencies in difficulty levels, leading to more reliable and accurate assessments.

4. Customizable Question Papers: Educators can tailor question papers based on subject, difficulty level, and number of questions. This feature enhances flexibility, making exams adaptable to various curricula and institutional guidelines.

5. Scalability and Accessibility: The system is designed to be scalable, catering to a wide range of educational institutions, from schools to universities. Additionally, the ability to generate question papers in PDF format enhances accessibility and ease of use for educators.

CONCLUSION

The Bloom's Taxonomy-Based Question Paper Generation System Using Machine Learning Algorithms represents a significant advancement in educational technology. By automating the traditional process of question paper creation, it enhances efficiency while maintaining the quality and relevance of assessments.

Through the integration of machine learning and Bloom's Taxonomy, the system facilitates exam customization and ensures a balanced evaluation of cognitive skills. Its user-friendly interface and automation features reduce administrative workload, making exam preparation more convenient.

This system is adaptable for use across various educational institutions and government examinations, contributing to a more effective assessment process. Overall, it stands as a transformative innovation that streamlines and enhances the way question papers are designed and managed in educational environments.

ACKNOWLEDGEMENT

We are truly grateful to everyone who has supported and guided us during this journey of learning and discovery. We would like to thank Dr. L.V. Kamble, Principal of Siddhant College of Engineering, Pune, for his valuable feedback and for allowing us to undertake this project. A special thanks to Prof. N.S Kulkarni , Head of the Computer Engineering Department, for her helpful suggestions and continuous guidance throughout the project.

We also want to express our heartfelt thanks to our Internal Guide, Prof Apeksha Pande, and the faculty and technical staff of the Computer Engineering Department for their constant support and guidance, which was crucial to completing this project. We are also thankful to our classmates for their help and encouragement during this time.

We would like to acknowledge the support from industry experts and lab technicians, whose contributions added great value to our project. Lastly, our deepest gratitude goes to our parents for their unconditional support and motivation throughout this journey.

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