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# Design and Implementation of a Syllabus-Driven Examination Paper Framework

**P. Rahul Kumar**
*Computer Science & Engineering*
*School of Engineering & Technology*
*Dhanalakshmi Srinivasan University*
**Trichy, India**
rahul.pidikiti9@gmail.com

**S. Venkata Siva Reddy**
*Computer Science & Engineering*
*School of Engineering & Technology*
*Dhanalakshmi Srinivasan University*
**Trichy, India**
sivareddysanepalli1@gmail.com

**M. Venkata Bhanu Prakash**
*Computer Science & Engineering*
*School of Engineering & Technology*
*Dhanalakshmi Srinivasan University*
**Trichy, India**
mothukurivenkatabhanuprakash@gmail.com

**Dr. J. Mercy Geraldine**
**Professor**
*Computer Science & Engineering*
*School of Engineering & Technology*
*Dhanalakshmi Srinivasan University*
**Trichy, India**
mercygeraldine@gmail.com

***Abstract* - Manual preparation of question papers is a time-consuming process, which may result in problems like repeated questions, imbalance in syllabus coverage, and incorrect distribution of marks. Automated question paper generation systems assist in minimizing faculty effort and ensuring uniformity in the preparation of examination question papers. In this proposed project, a syllabus-based question paper generator system is proposed, where the faculty member uploads the syllabus document, and the system automatically generates a formatted question paper based on the syllabus content. Based on the identified topics in the syllabus, the system computes unit-wise weightage and allows flexibility through Auto Weightage, Equal Weightage, and Custom Weightage options. The system also allows the inclusion of Bloom's Taxonomy levels to develop questions based on various cognitive levels like Remember, Understand, Apply, Analyze, Evaluate, and Create. Finally, the generated question paper is formatted as per the required exam pattern and exported as a PDF file for printing purposes.**

***Keywords*— *Question Paper Generator, Syllabus Extraction, Unit Weightage, Bloom's Taxonomy, Difficulty Balance, PDF Export, Django.***

## I. INTRODUCTION

Examinations are one of the most common methods for evaluating how well students have learned, comprehended and problem-solved in an academic setting. One of the most critical aspects of any examination is the preparation of questions. The quality of the question paper directly affects how fairly and effectively students are evaluated. Traditional methods of preparing question papers involve manual production by faculty using syllabuses, textbooks and previous years papers. Faculty have complete control of the question paper preparation process, however, it takes an extraordinary amount of time to organize and create a balanced question paper. Consequently, manually prepared question papers result in the same questions appearing on numerous papers, improper distribution of marks on question papers, unequal distribution of unit coverage across papers, and inconsistent levels of difficulty between question papers when multiple faculty members prepare the same subject question paper [1].

Automated question generation systems have been developed in recent years, in order to reduce manual effort and improve the standardization of exam papers. The goal of these systems is to automatically generate structured exam papers according to pre-defined constraints including mark allocation, difficulty levels and coverage of topics[2]. A number of studies indicate that automation will reduce

the workload of staff creating exam papers, increase the speed of exam paper production and allow institutions to uphold the same standards when conducting exams [3]. Additionally, some recent approaches to automated question generation are using intelligent techniques such as Natural Language Processing (NLP) and transformer-based models to automatically create questions from educational resources. AI based approaches have the added advantage of dynamically creating new questions through the use of context and logic and do not require a large, pre-existing database containing previously generated questions [4]. However many of the current alternatives to automated question generation still require manual selection of the unit or static formulaic patterns and therefore have limited ability to cater for various types of examination and academic requirements.

To create an effective question paper, it is essential to assess students using a variety of cognitive skills rather than just memory skills. One example of how to do this is through the use of Bloom's Taxonomy, which gives you a framework for classifying questions based on cognitive skills (Remembering, Understanding, Applying, Analyzing, Evaluating and Creating). When Bloom's Taxonomy is incorporated into the question design process, students are assessed on both basic understanding and higher-level thinking skills. Studies have demonstrated that using Bloom's classification to guide the generation of assessment items will produce balanced distribution of questions and quantifiable learning outcomes [4]. Nevertheless, although several practical tools exist for generating question papers, many of them do not have an appropriate mechanism or process to include the Bloom level distribution of the generated questions in the examination. As a result, many question papers are produced that are too easy, too hard or biased toward specific higher or lower cognitive levels [5].


Fig. 1. Workflow Of Question Paper Generator

This overview flowchart outlines the process of the Syllabus-Based Question Paper Generator, which generates exam papers based on the syllabus provided by the faculty member. The faculty member first uploads the syllabus in PDF format, which outlines the topics for each unit in the syllabus [6]. The system then reads the syllabus PDF and automatically extracts the syllabus content by identifying the unit numbers and topic headings. Once the syllabus content has been extracted, the system calculates the weightage of each unit using either equal distribution or custom rules [7]. The user enters exam rules such as total number of marks, the type of breakdown for sections on the exam, the level of difficulty of the exam, and the levels of Bloom's taxonomy for the questions on the exam paper [8]. Using these restrictions defined by the user, the system will produce a structured exam paper that will maintain the integrity of the format and ensure balanced coverage. The final output will be a PDF file of the generated exam paper which can be printed or downloaded for use during an actual exam.

## II. LITERATURE SURVEY

Multiple research studies have been conducted that focus on automating the generation of exam papers in order to lessen the burden of teachers as well as increase the effectiveness of exam paper creation. Most companies that are currently producing these automated systems primarily focus on the use of prescriptive templates, fixed marking systems and exposition of questions to create exam papers through the use of the above sources [1]. While these methods are time-saving and provide for greater consistency when producing exam papers, they rely heavily upon the faculty to select the educationally relevant question set that they will use, or they will use a pre-defined question set that was provided to them by another source, thus generating an increased amount of repetition in the questions and requiring a great deal of faculty time to keep the same question set current [2].

A number of studies show how artificial intelligence and/or natural language processing methods are being applied within educational systems, particularly in the context of extracting information from unstructured text files (i.e., documents) and transforming that information into a structured format as input to automated question generation systems [3]. For example, there are many different types of systems with various methods for extracting semantic content from documents using techniques such as PDF parsing, keyword extraction and topic classification that can be used to generate automated questions [4]. Despite these systems all having similarities with respect to their underlying methods of operation; the majority of these systems have been developed without utilizing the syllabus as the basis for the generation of

automated questions; therefore, generating automated questions from multiple subjects creates an inflexibility in the generation of the automated questions [5].

Recently, there has been increasing attention on assessing based on syllabus-driven and outcome. Assessments need to reflect the units and be aligned to the students level of achievement using Bloom's Taxonomy [6]. While many papers have addressed Bloom level tagging and balancing the difficulty of questions with respect to each syllabus unit, there has been little success in implementing such a solution that incorporates an automatic approach to syllabus extraction, automatic calculation of unit weightage from the syllabus and allowing for customization by the teacher, all in one process [7]. As a result, this paper describes the proposed system that will provide a solution that automates the processing of the syllabus and generates a balanced question paper with minimal manual effort [8]. To date, there has been considerable interest in improving the automation of question paper generation through the use of Natural Language Processing (NLP) and document understanding technologies to process information contained within the syllabus text and extract important concepts and learning outcomes [9]. Some systems provide a means to generate questions using keywords associated with different topics and difficulty levels in order to eliminate some of the manual effort required and ensure appropriate coverage of the entire syllabus [10]. In addition to this, there has also been much discussion as to how to use systematic templates, marking schemes and an understanding of Bloom's Taxonomy (i.e. level of cognitive hardness) to ensure that the overall examination has a consistent level of cognitive hardness [11].

## III. PROPOSED SYSTEM

The proposed system is an Automatic Syllabus-Based Question Paper Generator. It can help faculty create question papers quickly, easily, and accurately. The main input to this system is the syllabus that has been uploaded (in PDF format). The teacher uploads the syllabus PDF to the system, which automatically reads and extracts the unit names and topic headings from it and processes the syllabus to determine the number of topics in each unit. The system then calculates each unit's weightage, so that all units are represented on the generated question paper in accordance with the syllabus's structure and proportionally to the number of topics contained within each unit.

The system also allows the teacher to decide what type of question paper they would like to generate by specifying their criteria, such as the total number of marks available, how many sections there should be, how many marks should be allocated per section, and what difficulty level the questions will have. Additionally, the system has been designed with Bloom's Taxonomy levels (i.e., Remember, Understand, Apply, Analyze, Evaluate, and Create) so that the teacher can generate question papers that have a balanced cognitive load based on Bloom's Taxonomy levels. Finally, using the Automatic Syllabus-Based Question Paper Generator, the teacher can produce an entire question paper that maintains the unit's weighting, marking scheme and difficulty, and Bloom's Taxonomy distribution, and produce a PDF version of the question paper for printout and use at exam time. All of these features provide a fast and accurate way to prepare question papers, which will result in fewer manual errors than when manually preparing question papers.

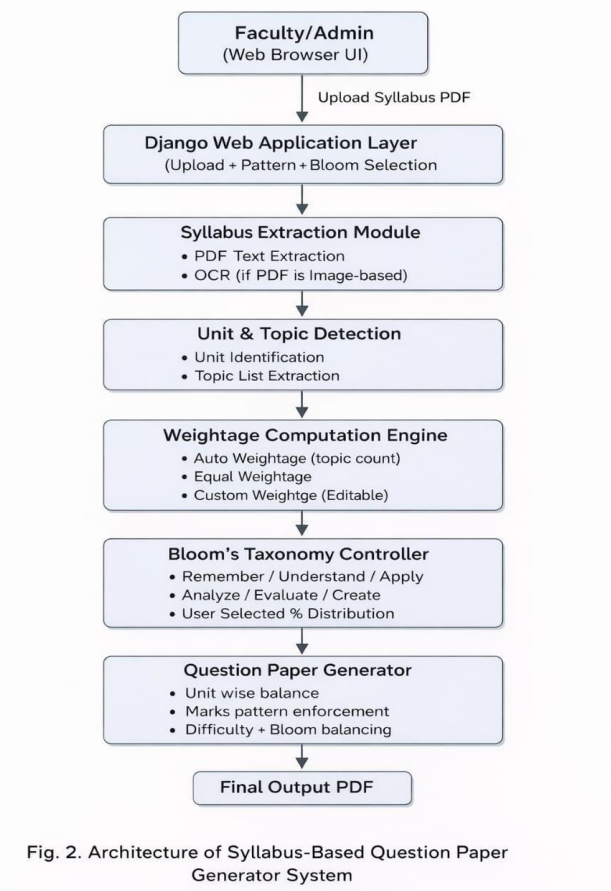



Fig. 2. Architecture of Syllabus-Based Question Paper Generator System

Figure 2 shows how to build a syllabus based question paper generator system. The architecture consists of uploading a PDF from the browser by either faculty or admin and then managing the syllabus using a Django web application. The application has several functions including that of uploading the Syllabus, selecting an Exam Pattern, applying appropriate levels of Bloom's Taxonomy. Once the syllabus is submitted it will then be processed by the Syllabus Extraction Module (i.e. extracting the text from the PDF). Then if the PDF is

image-based, this module applies Optical Character Recognition (OCR) to create an accessible representation of the available text.

This module is then processed by the Unit and Topic Detection module where it identifies all unit names and collects all topics associated with each individual unit. From these extracted units and topics the Weightage Compute Engine automatically generates a distribution of marks based upon number of topics. Each topic may have an equal distribution (i.e. all the same number of marks), custom editable weight (i.e. defined by the faculty member), or a topic count-based distribution (i.e. some weighted by number of associated topics). Then, the questions created are controlled by the Bloom's Taxonomy Controller which ensures that each of the questions meets particular cognitive level distribution (i.e. Remember, Understand, Apply, Analyze, Evaluate, and Create) and will create a balanced number of questions among in each cognitive level of difficulty level. Finally, a structured question paper will be produced from the generator by enforcing marks patterns for distribution of marks, unit by unit coverage for marks distribution, and evidencing a balanced number of questions per cognitive level. The output of this final product will then be rendered as a PDF document which is then downloadable and can be printed to finish the process of producing a question paper based upon the desired assessment items.

## IV. METHODOLOGY

The proposed syllabus-based question paper creator is developed as an online application created using the Django Framework, which is good at managing HTTP requests, creating views for rendering templates, and handling backend processes. The system is built as a layered architecture with the front-end (user interface) being where a faculty/admin person can upload PDF copies of syllabi and define the necessary rules for the examinations (i.e., the way that exams will be configured). The use of the MVC-like architecture (i.e. MTV design pattern) offered by Django allows for the separation of all three layers (Logic, View Templates, Database even though they will all exist within the same application) for better maintainability and scalability. In addition, this type of implementation allows for the modularization response of rapid development and rapid integration of features, such as file uploading, extraction processing and the generation of PDF files. The advantage of having a framework for implementing web-based educational automation solutions would be the overall improvement in efficiency and usability.

**(a) Faculty/Admin User Interface:**

Faculty members will use this module as an interface to interact with the system. The user is allowed to upload a syllabus PDF, set the exam pattern, and define the distribution of Bloom's Taxonomy prior to generating the question paper [7]. The web interface has been designed using Django templates for ease of use and navigation.

**(b) Syllabus Upload and Validation:**

The responsibility of this Module is to accept an uploaded Syllabus Document as input. The Module will validate the file to confirm that it is a valid PDF file. Once the file has been validated, it will be saved in a directory on the server and its associated Metadata (e.g., the Syllabus Title and File Path) will be stored in the database for processing after it has been uploaded.

**(c) Syllabus Content Extraction:**

The Syllabus Extraction Module reads a syllabus. If the syllabus is in a PDF and contains selectable text, the Syllabus Extraction Module performs a direct PDF text extraction process [8]. If the syllabus is a PDF that contains scanned images or is image-based, the Syllabus Extraction Module uses optical character recognition (OCR) processing to extract text from the syllabus document correctly. All extracted text will be used as the primary source of information for all units and topics.

**(d) Unit and Topic Detection:**

After extracting text, this module processes this data to identify individual content of each unit using pattern matching and formatting rules (examples include "UNIT I" or "UNIT II"). Once units have been identified, topics for each unit are extracted and structured, which allows for unit-wise mapping and is necessary to generate balanced question papers [2].

**(e) Weightage Computation:**

The Weightage Calculating Module does the work of allocating marks across various units, depending on which mode is chosen by the user. There are three options available for weightage allocation: Equal Distribution, Auto Distribution according to the number of topics, and Custom Edit for each Individual Weightage total (which is created by the user). This will result in a balanced and comprehensive approach towards covering the details of the syllabus when it comes to completing the final exam paper.

**(f) Bloom's Taxonomy Controller:**

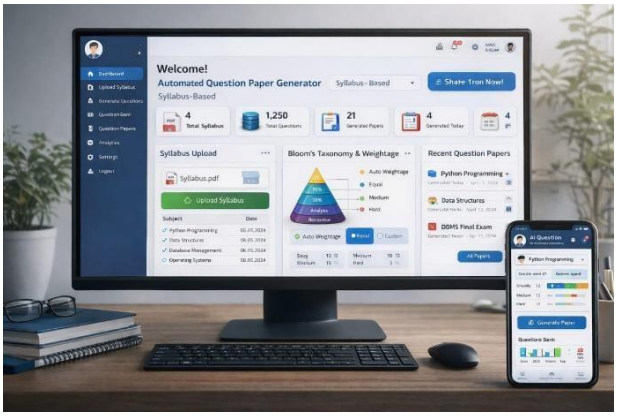
This module includes Bloom's taxonomy in its generation process. The user can define distribution percentages across the cognitive levels of Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating. It will then use the distributions for cognitive balance of the generated question paper [7].

**(g) Question Paper Generation:**

The system consists of a core module and generates a structured question paper using information from the topic

extraction, unit weightage, exam pattern and Bloom's taxonomy rules. The generated questions are formatted according to specifications and meet the desired balance between units as well as the distribution of difficulty and cognitive levels.

**(h) Final PDF Output:**




In this Module the finalized Question paper(s) gets formatted into printable PDF. The System generates an exam-ready version of the question paper by creating appropriate headings, sections, mark allocations and question numbers. The User can download this generated paper immediately.

## V. RESULTS AND DISCUSSION

The desired question prep generator was implemented and verified for its ability to create structured question papers automatically from the uploaded syllabus. The primary result of this system is that it has successfully automated the process of creating question papers and significantly reduced the amount of manual work being performed by instructors. When the user uploads a syllabus (in PDF format), the system uses the syllabus content to create a question paper based on the appropriate number of units/titles from each of the units in the syllabus, along with user-specified constraints. In contrast to a manual process for producing question papers (which requires considerable amounts of time and has a need to have verification throughout the manual process), this system reduces the total effort needed to create question papers/social promotions. Systems like this that have automated processes for producing question papers have also shown significant increases in time efficiency compared to other methods and a reduction in the number of human errors due to using automation for producing question papers.

The system produced an accurate unit-wise paper layout based on the automatically calculated weightings during the tests. The Auto Weightings mode allows for units with more topics to have a higher total mark distribution, thus creating a more fair distribution throughout the syllabus. The Equal Weightings mode distributes the marks for each unit evenly so that this mode can also be used for certain internal exams. The Custom Weightings mode enables faculty to adjust the distribution of units based on their departmental guidelines or preferences, which is often not available using standard automated paper generation systems.

Utilizing Bloom's taxonomy distribution to better balance the cognitive level of question generation. The question papers were generated with a mixture of lower-order and higher-order cognitive-based question types based on a Bloom taxonomy distribution selected (Remember, Understand, Apply, Analyze). As a result, the quality of assessment was improved; Bloom-based classifications have been largely accepted in the theory and practice of outcome-based evaluation, and the assessment of student learning.

In summary, this output of the generated question paper is in printable PDF format; thus, it can be very useful to the faculty on exam day. As part of the entire workflow process from uploading syllabus through to exporting the PDF will help streamline preparation as well as ensure standardization through quicker timeframes. Additionally, compared to traditional generate question papers, this system offers greater automation based on use of syllabus-driven processing with unit weightings as well as cognitive balancing according to Bloom's taxonomy. When considered overall, use of this system should produce more consistent and flexible question paper generation.

## VI CONCLUSION AND FUTURE SCOPE

The Automatic Question Paper Generator (AQPG) is a system based on the syllabus that aids in reducing the amount of manual effort required to create exams and add consistency to the way they are prepared. The AQPG also analyzes the syllabus submitted to it by users, breaking it into manageable units and topics, and generating a question paper that meets a user's selected weightage patterns: Auto Weightage, Equal Weightage, or Custom Weightage. Additionally, the AQPG will allow users to create questions that correspond with Bloom's Taxonomy distribution to achieve cognitive balance within the questions created by the AQPG. After generating the question paper, the AQPG will create a single PDF that can be printed and provided to the faculty for use when preparing exams. In summary, the AQPG allows the user to generate question papers with greater efficiency,

provides for an equitable distribution of marks, and provides a uniform and flexible method for automatically generating question papers.

The future of this system will see improvements through the introduction of an AI Question Bank Generator. This means that with intelligent models, high-quality questions based on syllabus topics can be generated automatically without any activities of users/teachers. The use of AI-complementary technologies such as Natural Language Processing (NLP) and transformer AI will enable us to generate a variety of question formats, including short answer, long answer, multiple choice, and application-based questions while still adhering to Bloom's taxonomy levels and maintaining an even distribution of difficulty across question types.

Another important enhancement is the development of an AI-based Syllabus Generator Framework. In this feature, faculty can provide subject details, course objectives, and reference materials, and the system will automatically generate a structured syllabus with units, topics, and suggested hours. This will help institutions design new courses quickly and maintain standardized syllabus formats.

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