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NoteSync: An AI-Based Academic Learning and Evaluation System

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Abstract: *The increasing use of digital education will progressively require new systems that would allow for both personalized learning and efficient evaluation among the current available systems primarily use general content & manual grading, which is often time-consuming and not consistent with one another. This paper presents an innovative AI-based academic learning & evaluation system called NoteSync, which combines the two in a single intelligent framework. The NoteSync system utilizes a Retrieval Augmented Generation (RAG) methodology for assisting students in their learning from personal study materials. Through the semantic representation of the information uploaded into the system database, NoteSync accomplishes using a large language model to both retrieve pertinent information from databases, generating the contextually based answer. To achieve an important component of the evaluation side of NoteSync, grade students' answers through various assessments: rule-based, rubric-based, and ML (machine learning). This ensures efficient and systematic evaluation of students. Another important attribute of NoteSync will incorporate the ability to learn from previously graded essays to improve its adaptability towards each individual faculty member's grading practices. In addition to the extensive evaluation process described above within the system, NoteSync provides an extensive assignment management system and a one-click evaluation feature helping to minimize manual grading and vastly improving scalability. Results indicate the NoteSync system provides substantially increased relevant answers, significantly improves consistency of grades, and supports a more efficient academic workflow.*

Keywords: *Artificial Intelligence, Retrieval-Augmented Generation (RAG), Document-Centric Learning, Automated Evaluation, Semantic Similarity, Natural Language Processing (NLP), Machine Learning, Vector Database.*

I. INTRODUCTION

The growing use of digital technologies in education has changed how students learn and how we assess academic performance. Despite these changes, two main challenges remain in today's educational systems. First, there is a lack of personalized learning resources. Second, the process of manually evaluating answers is often inefficient and inconsistent. Traditional learning platforms usually depend on generic content that may not meet the specific needs of individual students or particular academic materials. At the same time, conventional evaluation methods take a long time and can be affected by human bias and variability.

Recent advancements in Artificial Intelligence (AI), Natural Language Processing (NLP), and Machine Learning (ML) have created new opportunities to tackle these limitations. Specifically, Retrieval-Augmented Generation (RAG) has become a useful method for providing context-aware and knowledge-based responses by merging information retrieval with generative models. Likewise, automated evaluation techniques that use semantic analysis and learning-based models have demonstrated promise in enhancing grading accuracy and consistency.

This paper presents NoteSync, an AI-based academic learning and evaluation system that combines personalized learning with smart answer evaluation in a single framework. The system includes two main modules: a student learning module that uses a RAG-based approach to generate responses based on user-provided academic materials, and a faculty evaluation module that supports rule-based, rubric-based, and machine learning-based grading strategies. A key contribution of the proposed system is its ability to learn from previously evaluated answer scripts.

This allows for adaptive grading that reflects the evaluation patterns specific to each faculty member. Additionally, the platform includes assignment management and one-click evaluation features. These improvements significantly reduce manual workload while maintaining consistency and scalability. By combining AI techniques with practical academic needs, NoteSync aims to improve the learning experience for students and the efficiency of evaluation for educators. This contributes to developing more intelligent and effective educational systems

II. LITERATURE SURVEY

Recent progress in Artificial Intelligence (AI) and Natural Language Processing (NLP) has had a big impact on the growth of smart educational systems.

Retrieval-Augmented Generation (RAG) is one of the most powerful methods. It combines information retrieval with generative models to make responses that are based on knowledge and aware of the context. Lewis et al. [1] proposed RAG as a way to make knowledge-intensive NLP tasks work better by combining language models with external document retrieval. Karpukhin et al. [2] also came up with Dense Passage Retrieval (DPR), which uses dense vector representations to make finding relevant information faster and more accurate.

Pre-trained transformer models like BERT [3] have been very important for understanding the meaning of text, and they are the basis for many natural language processing (NLP) applications. Reimers and Gurevych [4] enhanced this functionality with Sentence-BERT, which produces meaningful sentence embeddings for semantic similarity tasks, rendering it exceptionally suitable for applications like answer evaluation and document retrieval.

Several studies have investigated the application of AI for grading student responses within the framework of automated evaluation. Dikli [11] talked about automated essay scoring systems and how they could cut down on the amount of work that needs to be done by hand and make things more consistent. Burstein et al. [12] talked about the E-rater system, which uses language and statistics to rate written answers. A lot of traditional systems, on the other hand, depend on pre-set features and can't change to fit different grading styles.

Machine learning and embedding-based similarity techniques have helped modern AI systems get around these problems. These methods let you grade based on the meaning of the words instead of the exact match of the keywords, which makes grading more flexible and accurate. Also, vector databases like Qdrant [7] have made it easier to store and get high-dimensional embeddings, which makes real-time applications possible.

Even though these systems have come a long way, most of them only focus on either personalized learning or automated evaluation, and not both in one system. Also, a lot of systems don't work well in academic settings because they don't adapt to the grading patterns of individual faculty members.

The suggested system, NoteSync, fills these gaps by combining RAG-based personalized learning with a hybrid evaluation method that uses rule-based, rubric-based, and machine learning methods. It also adds adaptive evaluation by learning from answer scripts that have already been graded. This makes the grading more consistent and fits with the way that faculty members assess students. Automated answer assessment has been researched thoroughly as well. Earlier solutions, according to Dikli [11], were based on automatic essay marking through the use of linguistic characteristics like grammar, vocabulary, and style. Further developments, among which the E-rater system by Burstein et al. [12] can be mentioned, utilized statistical and NLP methods to improve the precision of grading. Yet, these systems have difficulties in assessing semantic comprehension and may fail in cases where students provide different formulations for the same answer.

Modern developments in this field have focused on utilizing machine learning for evaluation based on semantic similarity and embedding. The main principle underlying this method is to compare the answer given by the student to the reference answer in an N-dimensional space. An essential innovation in the sphere concerns the application of vector DBs like Qdrant [7].

Despite these advancements, existing solutions exhibit several limitations. Most systems focus either on learning assistance or evaluation, but not both in an integrated manner. Additionally, many automated grading systems do not account for faculty-specific evaluation styles, leading to inconsistencies in grading. The lack of adaptive learning from historical evaluation data further limits their effectiveness in real-world academic settings.

In this paper, the system proposed – NoteSync – tries to solve the aforementioned problems using personalized learning based on RAG and hybrid evaluation based on rule-based evaluation, rubric-based evaluation, and machine learning-based evaluation. The main novelty of this system is the learning of previous evaluations of answer scripts, which allows grading based on the preferences of faculties.

III. METHODOLOGY

This proposed system NoteSync adopts a modular approach for its design that employs AI-powered learning and assessment. The approach to this system can be broken down into two main modules. These include the Student Learning Module and the Faculty Evaluation Module.

A. Student Learning Module (RAG-Based strategy)

This section of our system involves applying the concept of RAG to allow for individualized learning through documents. First, the learners will upload academic documents like PDF files, notes, and textbooks. Preprocessing of the documents will include activities like text extraction, cleaning, segmentation, and chunking, followed by creation of semantic embeddings based on transformer algorithms (for example, BAAI/bge-small).

These embeddings are then stored in the vector database (Qdrant) for efficient similarity searches. The moment a student makes an input, an embedding is made out of that as well and searched for relevant answers from the existing vectors. This contextual information is then sent to the Large Language Model (LLM - Gemini API), who produces relevant responses based on the student's notes or books.

B. Faculty Evaluation Module (Hybrid Evaluation Approach)

The evaluation module adopts a hybrid methodology combining rule-based, rubric-based, and machine learning-based techniques:

- 1) Rule-Based Assessment: Grades are awarded according to pre-set criteria, including key terms, definition, organization, and elements.
- 2) Rubric-Based Assessment: The answers are marked using qualitative assessment standards and pre-set performance criteria.
- 3) Machine Learning-Based Assessment: Employed semantic similarity methods to grade students' answers against the reference answer and previous scripts.

The system includes a learning module that uses evaluation data collected from previous evaluations. The system uses embedding of previously graded answers for identifying grading patterns specific to faculties. It compares new answers against the identified pattern and predicts grades that match their evaluation criteria.

C. System Integration and Architecture

The faculty members may assign tasks or examinations to the students, set deadlines, and even receive assignments from the learners. After receiving the assignments from the students, the evaluation is automatically done by clicking on a button.

D. System Integration and Architecture

The system was created based on a front-end developed using React and a back-end built on FastAPI. The tasks performed by the back-end include document processing, embedding, vectorization, queries retrieval, evaluation processes, and interfacing with external AI services like the Gemini API. Using the described approach, NoteSync realizes personalized learning and adaptation, as well as effective workflow management.

IV. IMPLEMENTATION

The development of the NoteSync application is executed using a full-stack approach where the latest web technologies are utilized together with the AI and machine learning tools. It is developed in such a way that the efficiency and interconnectivity between the modules become possible.

A. Frontend Development

The UI is designed with the use of React.js, ensuring interaction and responsiveness from both student and professor perspectives. The front end comprises distinct dashboards for uploading documents, entering queries, creating assignments, and displaying results. This is achieved through API calls to the back-end systems.

B. Backend and API Services

The back end has been developed using the framework known as FastAPI that manages the core functionality of documents, query handling, evaluation logic, and AI service management. FastAPI was selected because of its high speed and efficient management of asynchronous requests

C. Document Processing pipeline

The process starts with extracting text from uploaded files, which involves PDFs and documents. Then, the text is cleaned, segmented, and chunked. The chunks are then converted to vectors by applying the transformer embedding model (BAAI/bge-small). This allows for the capturing of the semantic meaning of the text

D. Vector Database Integration

The resulting embeddings are kept in Qdrant, which is a fast vector database that can be used for searching based on similarity. As soon as a student makes a query, the query itself will be transformed into an embedding and matched with other vectors

E. Response generation using LLM

This context is then used by a Large Language Model (the Gemini API) to generate contextually correct responses. This guarantees that any responses provided by the LLM are informed by the student's course materials and not external sources.

F. Automated Evaluation Engine

The evaluation module has been designed as a combined solution:

- Rule-based logic has been applied to detect structural features, such as keywords and the form of the answer.
- Rubric-based assessment has been designed according to the set scoring parameters.

The machine learning-based assessment module detects similarity in embeddings between student answers and correct ones.

G. Assignment Management System

The faculty can use the platform to set up assignments, establish deadlines, and receive the completed assignments. When the assignments are submitted, the platform provides a single click evaluation process, which evaluates all the answers submitted.

H. System Integration and workflow

Everything is connected through the RESTful API. The whole process starts with uploading the documents, then storing embeddings, handling queries, creating responses, and evaluating. The modular approach helps make sure that everything works independently while supporting the entire process. With the help of this architecture, NoteSync becomes able to efficiently process documents, create intelligent responses, and do automated evaluations

V. RESULTS AND DISCUSSION

Performance assessment of the NoteSync system was carried out using various parameters, such as accuracy, answer relevance, consistency of assessment, and efficiency of the model. It is evident that integration of the RAG model with hybrid evaluation systems can lead to improved learning and testing procedures.

In the student learning module, the application of document-centric retrieval helped ensure the accuracy of the output as it was closely related to the documents uploaded. As opposed to the typical generative model that operates using general knowledge, the RAG approach was more accurate because its outputs were closely aligned to the curriculum.

However, the evaluation tool performed satisfactorily with regard to the evaluation of grading consistency. Hybrid evaluation, which used rules based, rubric-based, and machine learning based evaluations together, helped in assessing both structure and meaning in a balanced manner. Rule-based evaluations helped in correctly identifying essential elements like definitions and key words, while machine learning algorithms helped in detecting semantics.

Another important output of this project is the ability of the model to learn from previous evaluations done for answer scripts. By using the principle of embedding based similarity, this system adapted itself according to the faculty's grading pattern, which led to more objective grading of answers.

Regarding efficiency, the 'one click evaluation' feature enabled quick assessment of numerous student scripts in less time. In addition, using FastAPI and vector database enabled quick response time for retrieving query and evaluation purposes.

Nevertheless, some constraints were identified. First, the validity of assessment is affected by the correctness of the reference answers as well as previous experience. Furthermore, the system may need the human factor for evaluating highly subjective and creative answers.

On the whole, these results show that NoteSync positively contributes to personalization, improves the consistency of grading, and saves instructors' time. Thus, there are significant chances for using this system in practice, especially when scalability and intelligence are needed.

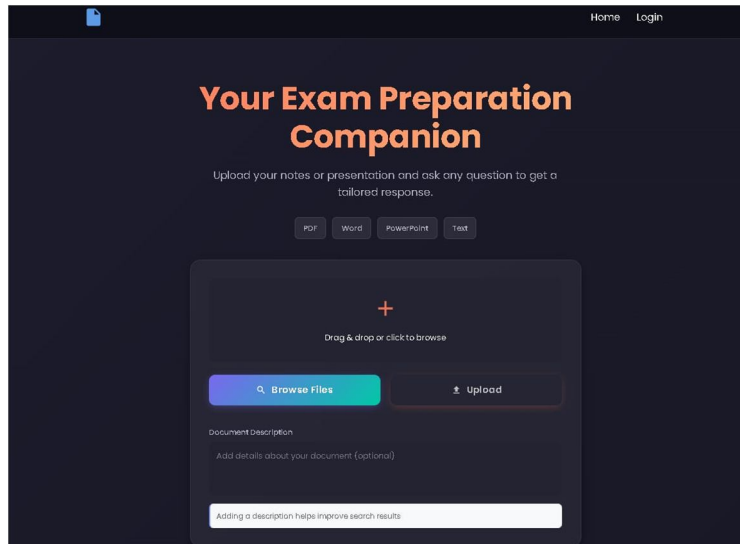


Figure (1): User Role Selection Interface of NoteSync

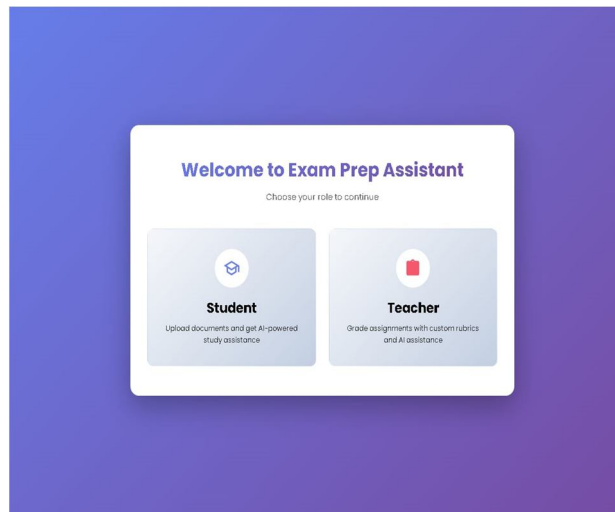


Fig.(2). Role Selection Interface of the NoteSync System

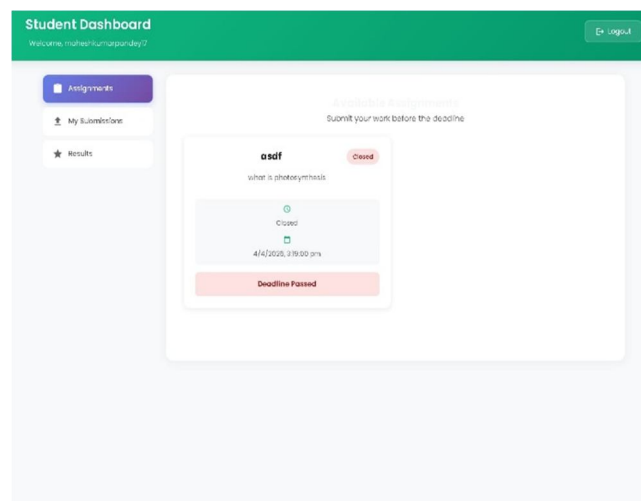


Fig.(3). Student Dashboard Interface of the NoteSync System

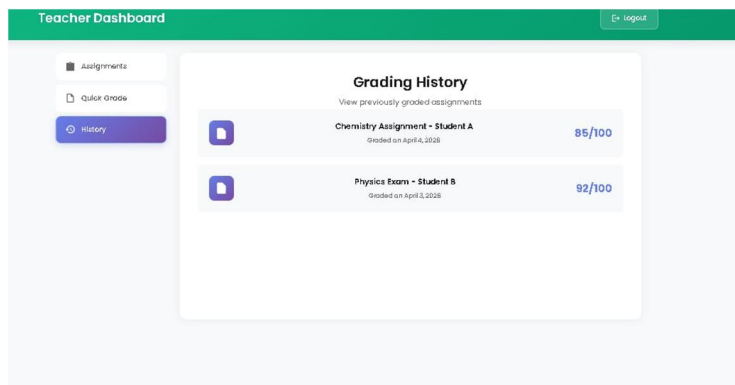


Fig.(4). Teacher Dashboard Showing Grading History in NoteSync

VI. CONCLUSION

NoteSync: AI-Based Learning & Evaluation for Academics was the title of the paper in which an AI-Based Academic Learning and Evaluation System named NoteSync was introduced. This system was developed to cater to the major problems faced by the current educational system, namely, the absence of personalized learning and the time-consuming process of evaluations.

With regard to the student module, the generation of relevant responses using context awareness based on the syllabus makes use of academic material provided by the students, making the content more relevant and improving the retention of information when compared to normal generic learning tools. For the faculty module, the consistency and objectivity in grading is provided via learning from past data.

However, through assignment management and one-click evaluation, manual intervention is minimized, thus improving the scalability of the system. Based on experimental observation, the following benefits have been realized with regard to the implementation of the system.

Though this model proves effective, high-quality reference data might be necessary for maximum efficiency, while some subjective answers might need human verification. Future research could be devoted to improving the assessment models for subjective questions, including multimodal data sources such as pictures and graphs, and boosting the system's versatility for various fields of study.

In conclusion, NoteSync shows that artificial intelligence-based technology is capable of revolutionizing education through connecting personalized learning with intelligent evaluation.

REFERENCES

- [1] P. Lewis et al., "Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks," Advances in Neural Information Processing Systems (NeurIPS), 2020.
- [2] T. Karpukhin et al., "Dense Passage Retrieval for Open-Domain Question Answering," Proceedings of EMNLP, 2020.
- [3] J. Devlin, M.-W. Chang, K. Lee, and K. Toutanova, "BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding," Proceedings of NAACL-HLT, 2019.
- [4] N. Reimers and I. Gurevych, "Sentence-BERT: Sentence Embeddings using Siamese BERT-Networks," Proceedings of EMNLP, 2019.
- [5] OpenAI, "GPT Models and Applications," Available: <https://openai.com/>
- [6] Google, "Gemini API Documentation," Available: <https://ai.google.dev/>
- [7] Qdrant, "Qdrant Vector Database Documentation," Available: <https://qdrant.tech/documentation/>
- [8] BAAI, "BGE: General Embedding Models," Available: <https://huggingface.co/BAAI/bge-small-en>
- [9] FastAPI, "FastAPI Framework Documentation," Available: <https://fastapi.tiangolo.com/>
- [10] React, "React - A JavaScript Library for Building User Interfaces," Available: <https://react.dev/>
- [11] S. Dikli, "An Overview of Automated Scoring of Essays," Journal of Technology, Learning, and Assessment, vol. 5, no. 1, 2006.
- [12] E. Burstein, J. Tetreault, and J. Madnani, "The E-Rater® Automated Essay Scoring System," Handbook of Automated Essay Evaluation, 2013.



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