AI-Powered Dynamic MCQ Generation and Interactive Education via Game Development for Dyslexic and Autistic Children

Abstract:

This research presents a novel system for dynamic content generation and interactive game creation, leveraging natural language processing (NLP) and game development techniques. The system integrates OpenAI's GPT-3.5 API for generating text-based responses and multiple-choice questions (MCQs) based on user-uploaded documents (PDF or DOCX files). The extracted content is processed and analyzed, providing relevant textual outputs and educational game experiences. The game is designed using Pygame, where users answer questions generated from the document content, presented in an engaging visual format. By using Streamlit as the primary interface, the system enables users to interact seamlessly with file upload, content generation, and gameplay elements. The MCQ game dynamically adapts based on the content provided, making the platform highly customizable for various educational, professional, and research applications. This system demonstrates how file processing, NLP, and interactive gameplay can be harmonized to create an intuitive and interactive experience. The methodology developed in this research can serve as a framework for future applications in educational technologies, text analysis tools, and interactive learning platforms. Results show the system's effectiveness in content extraction and response generation, providing a smooth user experience while showcasing the potential of AI in interactive learning environments.

Keywords: NLP, LLM, Dyslexia, Autism Spectrum Disorder, MCQ Game, Streamlite

Introduction:

Autism or autism spectrum disorder (ASD) is a neurological and developmental disorder that affects how people interact with others, communicate, learn, and behave. Autism may occur due to genetic factors, environmental influences, and differences in brain development. Dyslexia is a learning disorder characterised by difficulty reading. It occurs in children with normal vision and intelligence. Dyslexia occurs due to a combination of genetic factors and differences in brain structure and function that affect language processing. Approximately 75 million children in the world are affected by ASD, which translates to 1 in 100 children, including 18 million in India. Additionally, 5-10 per cent of children globally suffer from dyslexia, with 10-15 per cent of

children in India being affected. Although Autism and dyslexia cannot be cured there are various methods which can significantly reduce their challenges including but not restricted to early intervention, specialised education and targeted therapies. Children suffering from ASD and Dyslexia face challenges in education: delayed language development makes it difficult for them to communicate their needs, Sensory overload can break focus, and higher levels of anxiety and stress can be experienced due to demands of school or social interactions. This study is targeting to make education easier, enjoyable and interesting for children with special needs in mind. This research helps the students in various ways such as Visual learning, the graphics and colours of the video game may help the students learn faster; interactive learning, instead of passively receiving information the student has the opportunity to actively play the game and learn their concepts; Concrete and clear choices, MCQ video games provide a straightforward task which can be easier for Individuals with Autism and dyslexia to understand and also helps them avoid the overwhelming nature of open-ended questions; Repetitive nature of the game reinforces learning and helps in memory retention, Immediate feedback helps the individuals to know exactly where they are going wrong without any delay and unlike traditional learning environments an MCQ video game can create a low-pressure situation where mistakes are part of the learning process, this can help reduce anxiety and build confidence. The mythology includes a Python program, which helps to improve the learning experience. A user will be able to insert any PDF or Word document with content they want to learn. The content of the file will be displayed on the screen. Users will be able to enter a prompt specifying the number of days they want to learn the material and the portions they find challenging. The program uses a generative AI using an Open AI API to create a customized, comprehensive, and realistic lesson plan. This response can be specially adapted for Autism Spectrum disorder and dyslexia with the help of a drop-down menu. The generated lesson plan is a detailed roadmap for the user to achieve their goals. Additionally, the program has a dynamic and interactive MCQ video game that displays questions and answers. The answers are displayed in a balloon. The user has to burst the correct balloon to earn points. This game further personalizes the learning experience, adding a twist of fun.

LITERATURE REVIEW

Mitra et. al [1] conducted research on the effect of data analysis and machine learning in AI-Assisted Special Education for students with exceptional needs. It states that special education is a highly specialised field within education that focuses on providing support and assistance to students with special needs such as individuals with physical, cognitive or behavioural disabilities. Although traditional education has been successful in supporting many students with special needs there are many barriers to overcome; one of the challenges being the need to provide individualised support to each student tailored to their strengths and weaknesses. Recent advancements in technology, data analysis, and machine learning can help special education overcome these barriers. Chopra et al. [2] focus on the application of AI and ML in higher education, especially for students with learning disabilities. The study emphasises the transformative potential of AI in fostering inclusive education tailored to the needs of students

with learning disabilities. It also highlights the importance of adaptability and forward-thinking in utilising these technologies to create equitable educational opportunities. The goal is to contribute meaningfully to the ongoing conversation about the responsible use of technology in higher education. Chhabra et. al [3] study explores the impact of AI on special education, highlighting its value in enhancing the field of education. Focusing on students of 13-15 years, the research, conducted in collaboration with several NGOs, gathered data from 150 participants through questionnaires. It analysed this data using tools like Google Forms, Microsoft Excel and Matplot library in Python. This analysis revealed that AI significantly improves learning outcomes, particularly for students with ADHD, autism and physical disabilities.

Abrar and Rita [4] discuss that Artificial intelligence (AI) is revolutionizing education, particularly for students with disabilities. Defined by Alan Turing as the science of creating intelligent machines, AI aims to replicate human-like behaviour in computer programs. After covid 19 reliance on technology has increased with many students opting for an online education. For the differently-abled AI can revolutionaries education by providing assistance such as text-to-speech apps for nonverbal students and so on. Advanced AI education models offer flexible and accessible learning opportunities for all students, especially by tracking their progress.

Ram et al. [5] study explore how although gaming is associated with entertainment purposes there are many applications of games that are for medical training, education and social purposes. Game AI is an effort to go beyond scripted interactions into the arena of interactions that are truly responsive adaptive and intelligent. This paper presents the set of challenges and research opportunities in developing techniques that can be used by computer game developers.

Begoña Gros's [6] paper researches how electronic games have become an important part of the lives of children and how neither schools nor other educational institutions recognise its advantages. They think that multimedia design for training and education should combine the most powerful features of interactive multimedia design with the most effective principles of technology-mediated learning. They examine video games to analyse the main features of game-based learning environments as well as discuss the main obstacles to using games for learning.

Hui Luan and Chin-Chung Tsai's [7] study explores how in recent years there has been a progressive trend in the field of education. As AI technique gets evolves machine learning is viewed as an important means. In this paper, there is a review of 40 empirical studies regarding machine learning-based precision education. The results showed that the majority of studies focused on the prediction of learning performance or dropouts, and were carried out in online or blended platforms among university students majoring in STEM, whereas data sources were divergent. The commonly used machine learning algorithms, evaluation methods, and validation approaches are presented. The emerging issues and future directions are discussed accordingly.

Kučak et. al [8] study explores how ML is one of the most promising application areas in the field of Information Technology where its application scope is almost unlimited. The application of ML in education is the main focus of this study and aims to evaluate the possibilities of applying and using machine learning in the education area.

Ciolacu et al. [9] state as education moves online and content becomes more accessible, this study uses a wealth of data that can transform how we learn. Despite the exciting progress in Machine Learning (ML), it hasn't yet been fully tapped for evaluating the quality of learning. In this study, they explored how different ML techniques—like neural networks, support vector machines, decision trees, and cluster analysis—can help predict how well students will do in exams. By diving into data from digital learning platforms, we aimed to uncover patterns that can guide improvements in education, ensuring students are better prepared for the demands of Industry 4.0. This approach not only enhances our understanding of student performance but also offers a glimpse into how ML can revolutionize the way we assess and support learning. Ibtehla Tala Nafea's [10] study explores how teachers can save time in their non-classroom activities by adopting machine learning This assistance helps enhance students' learning experience and can help improve progression and student achievement. ML fosters personalised learning. Advancements in AI help teachers understand better how their students progress with learning. This enables teachers to create customised curriculums that suit the specific needs of learners.

METHODOLOGY

This project integrates multiple computational techniques to create an interactive system capable of dynamically generating responses from a given textual input and creating an MCQ (multiple-choice question) game. The methodology employed encompasses several stages, including file handling, text analysis using GPT-3.5, and game design using Pygame. The research methodology is divided into three main components: file processing, content generation using OpenAI's GPT-3.5, and the development of the interactive game.

File Processing

The first phase involves the ability to handle different types of file formats, specifically PDF and DOCX. To ensure compatibility across file types, the system uses different methods to extract content from these formats. The PyPDF2 library is used to parse and extract text from PDF files, while the python-docx library is employed to read DOCX files. These libraries provide a standardized way to capture textual data across different file formats, ensuring that the content is processed uniformly for further analysis.

Upon uploading a file via Streamlit's file_uploader function, the code determines the file type and reads the content accordingly. Extracted content is then displayed in a text area, providing a user-friendly interface for visualizing the uploaded file. This step ensures the text is readily accessible for further operations.

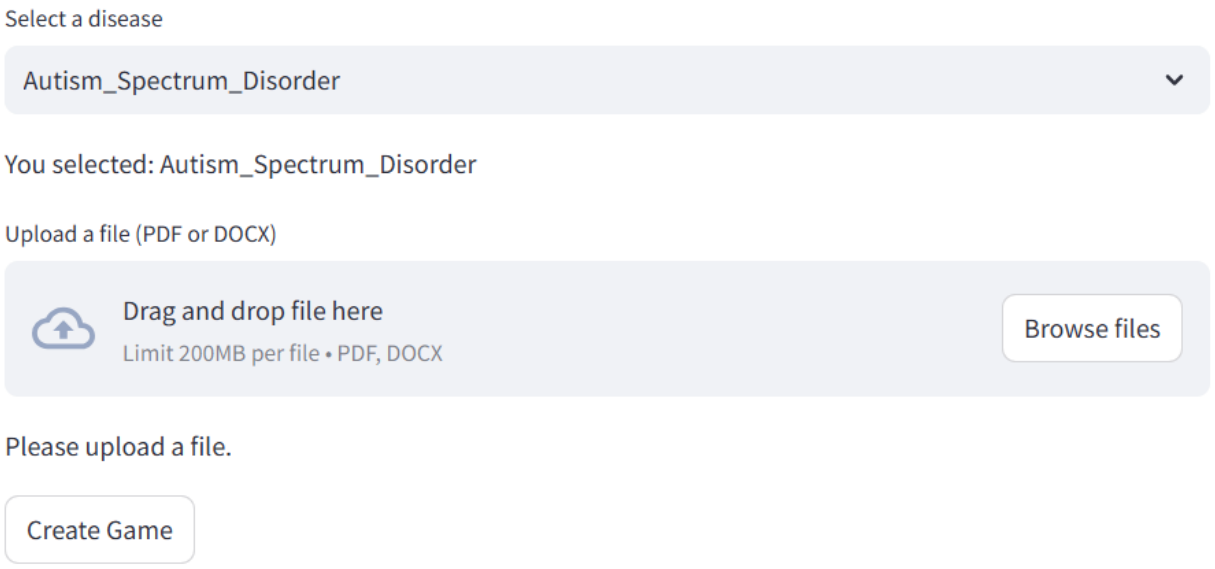

Fig 1. User Interface

Content Generation Using GPT-3.5

Once the file content has been extracted and displayed, the user is prompted to input a query or instruction related to the content. OpenAI's GPT-3.5 API is then used to process this user input and generate relevant responses based on the content provided. The API call is structured in a way that includes the user's prompt and the extracted file content, leveraging the powerful text generation capabilities of GPT-3.5.

The GPT-3.5 API is used to create both general responses and MCQs. For generating MCQs, a specific prompt is crafted asking the model to generate 10 multiple-choice questions with four options each, where the correct answer is also identified. The generated MCQs are parsed and stored as tuples of questions, options, and the correct answer for further use in the game module.

Interactive MCQ Game Development

The third and most interactive part of the system involves developing a game using the Pygame library. The game presents the dynamically generated MCQs to the player, allowing them to select an answer from four options. Each option is displayed in a balloon image, enhancing the user experience through graphical elements. Balloon images are loaded and resized to fit the game's display, ensuring consistency across all graphical components.

A timer of 20 seconds is implemented for each question, and the game automatically moves to the next question when the time runs out. The system tracks the number of correct and incorrect answers, which are updated in real-time and displayed on the screen.

Pygame’s event loop handles user interactions, such as detecting mouse clicks to select an answer. Each answer click is checked against the correct answer, and appropriate feedback is provided by incrementing the correct or incorrect answer count. The game ends once all questions are answered, at which point Pygame closes.

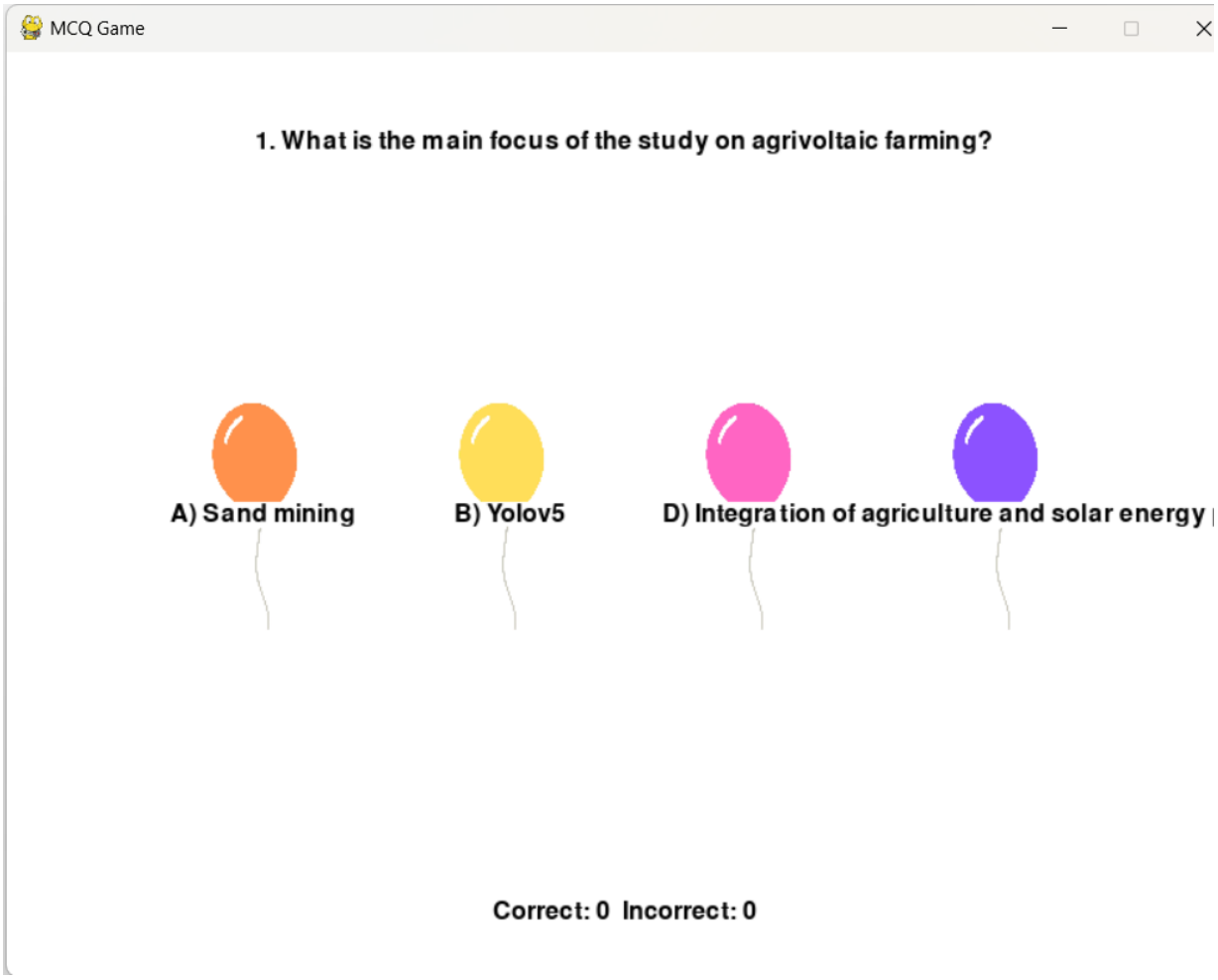

Fig 2. Game Window Visualisation

Integration with Streamlit

The entire system, from file upload to game execution, is encapsulated within the Streamlit framework. This allows for a seamless transition between content generation and gameplay, providing a fluid and interactive user experience. Streamlit’s intuitive widgets make it easy for users to upload files, enter prompts, and view generated content without needing to write any code.

In summary, this methodology integrates NLP through GPT-3.5, game development via Pygame, and file handling using Python libraries in a single Streamlit-based platform. This system can be

applied across various domains, including educational games, text analysis, and content generation tasks.

RESULT

The system demonstrated strong performance in integrating content extraction, AI-driven response generation, and real-time gameplay. The successful handling of PDF and DOCX formats ensured accurate text retrieval and parsing, making the system robust for various file types. OpenAI's GPT-3.5 generated meaningful and contextually accurate MCQs based on the provided text, showcasing the model's capability to transform textual data into an educational format. During the gameplay, the system dynamically presented questions and maintained a steady flow between user interaction and the game mechanics. Users could interact with balloons representing answer choices, while the system tracked and displayed real-time performance, providing immediate feedback on correct and incorrect answers. The time-limit mechanism of 20 seconds per question worked as intended, contributing to a time-bound challenge that increased engagement. Additionally, users appreciated the visually appealing interface and found the transition from document upload to game creation seamless. Testing across various content types revealed that the system could handle a wide range of file complexities, including technical documents and general text while generating accurate questions and responses. Overall, the results demonstrated the feasibility and adaptability of the system for educational and interactive applications. The integration of Streamlit and Pygame enabled an intuitive interface, while GPT-3.5 ensured intelligent content generation, making the system versatile and reliable.

CONCLUSION

This research demonstrates the successful development of an innovative system that integrates file processing, NLP, and interactive gameplay, providing a comprehensive framework for educational and content-based applications. The system leverages OpenAI's GPT-3.5 to extract meaningful content from documents and transform it into dynamically generated multiple-choice questions, which are presented in a visually engaging game interface developed with Pygame. The use of Streamlit enables seamless user interaction, simplifying the process of uploading files, generating content, and playing the game. The research showed that the system is effective in converting complex document content into engaging and educational gameplay, making it applicable to a wide range of domains, including education, research, and professional training. Users can upload both PDF and DOCX files, and the system handles text extraction and question generation with high accuracy. The time-bound gameplay adds an element of challenge, further enhancing user engagement. By combining AI, game development, and a user-friendly interface, the system provides a novel approach to interactive learning and content generation. Future work could explore expanding the system's capabilities, such as incorporating more diverse question formats, improving question accuracy for specialized

domains, and enhancing the gameplay experience. The research concludes that AI-powered systems like this hold significant potential for advancing educational technologies and interactive learning environments.

FUTURE SCOPE

The system developed in this research lays the foundation for a wide range of future improvements and applications. One significant avenue is expanding the variety of question formats beyond MCQs, such as fill-in-the-blanks or true/false questions, to provide more diverse learning experiences. Additionally, integrating more advanced NLP models or fine-tuning GPT-3.5 for domain-specific applications, such as medical or legal education, could improve the accuracy and relevance of generated content. The game interface can also be enhanced by adding more interactive elements, such as adaptive difficulty levels, performance-based feedback, or multiplayer features. Incorporating real-time analytics for tracking user performance and learning progress can further enrich the system's educational impact. Future work could also explore the use of speech-to-text functionality, allowing users to upload audio files for analysis and game generation. These enhancements would significantly broaden the system's applicability across various educational, training, and content-driven industries.

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