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Automated Multiple-Choice Question Generation Using Gemini Gen AI

Dr.P.R.Sudha Rani[1], Dr.Aaluri Seenu[2], Santhi Priya Nunna [3], Kolla Sasanka[3],
Mareddy Tejaswini [3], Marisetty Surekha [3], Sowmya Medapati [3]
[1]Professor, Department of CSE,Shri vishnu Engineering College for Women Bhimavaram,Andhra Pradesh,India.
Corresponding Author Email:prsudharaniscse@svecw.edu.in-ORCID: 0000-0003-2189-777X
[2]Professor, Department of CSE,Shri vishnu Engineering College for Women Bhimavaram,Andhra Pradesh,India.
Email:aaluiriseenu@svecw.edu.in-ORCID: 0000-0002-4975-1943
[3]Undergraduate, Department of CSE,Shri vishnu Engineering College for Women Bhimavaram,
Andhra Pradesh,India.

Abstract - In today's rapidly evolving educational landscape, the need for efficient and reliable assessment tools has never been greater. This project introduces an AI-powered system designed to automate the creation of multiple-choice questions (MCQs) across various subjects. By integrating the Gemini Gen AI API for natural language processing, Streamlit Python for an intuitive user interface, and pyttsx3 for text-to-voice functionality, this system simplifies and enhances the process of question generation.

Beyond its role in educational institutions, this system holds significant value for corporate training programs, online learning platforms, and automated assessment frameworks. By reducing the manual workload for educators and trainers, it promotes efficiency while maintaining high standards of question quality. As a step forward in educational technology, this project demonstrates the potential of AI in transforming assessment methodologies.

Keywords: MCQ Generation, Gemini Gen AI, Streamlit Python, Text-to-Voice, pyttsx3, Natural Language Processing, Automated Assessment, Education Technology

I. INTRODUCTION

The process of creating multiple-choice questions (MCQs)

is a critical aspect of educational assessment and training. However, manual MCQ generation can be time-

consuming, prone to errors, and inconsistent in quality.

With advancements in artificial intelligence and natural language processing, automating this process has become a viable solution.

This project aims to address these challenges by developing a system that leverages cutting-edge technologies to automate MCQ generation. The system utilizes the Gemini Gen AI API, known for its robust natural language understanding capabilities, to create contextually relevant and grammatically accurate questions. To ensure ease of use, the project integrates Streamlit Python to build

an intuitive web-based interface. Additionally, the inclusion of pyttsx3 enables text-to-voice conversion, making the system accessible to a broader audience, including visually impaired users.

Creating multiple-choice questions (MCQs) is an essential part of education and training, helping to evaluate knowledge retention and understanding. However, the traditional approach to designing MCQs is time-consuming, inconsistent, and requires significant human effort to ensure quality. With the growing need for scalable and efficient assessment tools, artificial intelligence and natural language processing (NLP) have emerged as promising solutions to streamline and automate this process.

This project presents an AI-driven system that simplifies MCQ generation by leveraging the power of advanced NLP models. The system integrates the Gemini Gen AI API, a powerful AI engine capable of generating meaningful, context-aware questions with well-balanced distractors. To enhance user interaction, the system features a web-based interface built with Streamlit Python, allowing educators and trainers to input topics, customize question sets, and generate quizzes effortlessly. Additionally, the incorporation of pyttsx3 provides a text-to-voice feature, improving accessibility for visually impaired users and making the platform more inclusive.

The system is designed to streamline the MCQ creation process for educators, trainers, and organizations, allowing them to focus on content delivery rather than the labor-intensive task of question formulation. This paper discusses the system's components, development process, and potential applications in educational and professional settings.

Teachers play a pivotal role in the platform by leveraging advanced AI tools to streamline educational assessments. They can upload topics or documents in various formats, such as plain text, PDFs, or DOC files, which are processed by the Gemini Gen AI API to generate high-quality multiple-choice questions (MCQs). The system also enables teachers to schedule question difficulty, and the number of questions. Once satisfied with the generated content, teachers can post quizzes for students through a seamless and intuitive interface, ensuring easy access.

Students benefit from an engaging and accessible learning environment. They can log in to the platform to access quizzes posted by their teachers. The user-friendly interface ensures a distraction-free experience during quiz attempts.

II. LITERATURE REVIEW

Both handwritten note recognition and voice to text the automation of educational assessment tools has been an area of growing interest in recent years, driven by advancements in artificial intelligence and natural language processing. Traditional methods of MCQ creation rely heavily on human expertise, which is time-consuming and may lead to inconsistencies in quality. This section reviews key developments in AI-driven question generation, accessibility tools, and interactive educational platforms that form the foundation of this project..

M. K. Hasan Chy [1] explored artificial intelligence-driven methods for automatic question generation, emphasizing natural language processing techniques. His research demonstrated that AI-based MCQ generation significantly reduces the workload of educators while ensuring question diversity and relevance. The study suggested future improvements through deep learning and reinforcement learning techniques for better contextual understanding of generated questions.

Chen, Ma, and Zhang [2] proposed a framework for automated grading in online assessments using machine learning algorithms. Their study compared the effectiveness of traditional rule-based grading methods with AI-driven automated assessment systems, concluding that machine learning improves evaluation accuracy while minimizing bias. The authors emphasized the integration of machine learning classifiers, such as decision trees and neural networks, to refine grading models.

Ning Wang [3] analyzed the role of role-based access control in secure online learning environments. The study discussed the importance of user authentication and data encryption in protecting quiz content and student responses. It highlighted the advantages of implementing multi-factor authentication, session-based access control, and encryption algorithms like bcrypt for securing login credentials and quiz data.

Shehzad Ashraf Chaudhry [4] conducted research on interactive learning platforms and their impact on student engagement. The study found that incorporating real-time feedback, personalized quizzes, and adaptive assessments improves student learning outcomes. The research proposed the implementation of gamification techniques, such as badges, leaderboards, and rewards, to enhance motivation and active participation in online quizzes.

Penghui Zhang et al. [5] introduced an adaptive learning system that dynamically adjusts quiz difficulty based on students' past performance. Their study highlighted the benefits of AI-driven question banks that personalize assessments for each student. The findings indicated that adaptive quizzes improve knowledge retention and help students focus on weak areas through targeted questioning.

Md Kamrul Hasan Chy [6] investigated security vulnerabilities in online quiz platforms, focusing on the risks of cheating and data manipulation. The research proposed AI-based anomaly detection techniques to identify unusual response patterns and prevent fraudulent quiz attempts. The study also suggested integrating keystroke analysis and browser monitoring to enhance online exam

security.

III. EXISTING SYSTEM

The existing systems for multiple-choice question (MCQ) generation and delivery predominantly rely on manual or semi-automated processes, which pose several challenges in terms of efficiency, scalability, and accessibility. This section highlights the key features and limitations of the current approaches used in educational and professional settings.

The current methods for MCQ generation and delivery primarily rely on manual and semi-automated processes, each presenting unique limitations. Educators and content creators often develop MCQs manually, ensuring alignment with learning objectives but facing challenges in terms of efficiency and scalability. The manual process is labor-intensive and prone to inconsistencies, particularly when scaling assessments across multiple topics and large datasets.

Many educational platforms integrate accessibility features such as text-to-speech tools; however, these functionalities often operate independently rather than as a cohesive part of the question-generation system. As a result, their usability is limited in assessment contexts. Furthermore, existing web-based interfaces for question generation tend to be rigid, offering minimal customization options for question format, topic specificity, and difficulty levels. Real-time processing and feedback mechanisms are also lacking in many current systems.

While some advanced AI-driven models have emerged for content generation, they largely focus on open-ended or descriptive questions rather than structured MCQs. Additionally, these systems often fail to include key features such as distractor generation, real-time feedback, and integrated accessibility enhancements. The main challenges within existing systems include the absence of fully automated MCQ generation, minimal accessibility support, limited adaptability to different educational needs, and inconsistent accuracy in generating contextually relevant and grammatically correct questions. Addressing these issues requires a comprehensive AI-driven approach that leverages NLP capabilities, user-friendly interfaces, and accessibility integration to create a more effective and inclusive learning environment.

Identified Challenges in the Existing System

One of the main challenges in the current system is the lack of automation in generating high-quality multiple-choice questions with plausible distractors. Creating quizzes manually is not only time-consuming but also prone to inconsistencies, especially when it comes to ensuring that the questions are both relevant and well-structured. This traditional approach results in inefficiencies and a lack of scalability when it comes to quiz creation, making it difficult to keep up with the demand for diverse and engaging assessments.

Another significant limitation is the minimal support for accessibility features, particularly the absence of text-to-voice integration in question-generation platforms. This lack of inclusive features creates barriers for students with visual impairments or those who prefer audio-based learning. An inclusive system with text-to-speech capabilities would empower all students, regardless of their learning preferences or disabilities, to access and engage with the content on an equal footing.

Lastly, existing systems sometimes struggle with consistently generating contextually accurate and grammatically correct questions. Since the quality of the questions directly affects the learning process, inaccuracies or poorly worded questions can confuse students and negatively impact their experience. This underscores the need for more advanced technology that ensures questions are not only contextually relevant but also adhere to proper language standards, ensuring clarity and consistency in assessments.

IV. PROPOSED SYSTEM

The proposed system introduces a fully automated, efficient, and accessible platform for generating high-quality multiple-choice questions (MCQs) using advanced AI technologies. By leveraging the Gemini Gen AI API, Streamlit Python, and pyttsx3, this system addresses the limitations of existing systems and offers a comprehensive solution for educators, trainers, and organizations.

The proposed system introduces a role-based access model that ensures an optimized learning and teaching experience. Teachers have the ability to create and manage MCQs, post quizzes in designated sections, and share them as PDFs with students. They can also upload lecture materials, which students can only access in read-only mode. Furthermore, teachers can monitor student performance, view quiz scores, and analyze progress to tailor their instructional strategies.

Students, on the other hand, can log in to the system to attempt quizzes assigned by their teachers. The platform ensures an engaging and structured assessment experience, enabling students to track their progress in real time. Students can also access uploaded lecture materials, providing them with structured learning content while maintaining content integrity through read-only access. Real-time feedback on quiz attempts helps students identify their strengths and areas for improvement, promoting a personalized and adaptive

learning experience.

The implementation of the MCQ-based learning system has demonstrated significant potential in enhancing digital education through automation, role-based access, and secure evaluation mechanisms. The system successfully allows teachers to create structured quizzes, post lectures, and evaluate student performance efficiently, while ensuring a fair and engaging assessment environment for students. By integrating AI-driven MCQ generation using the Gemini model, the platform significantly reduces the time required for quiz preparation, ensuring the diversity and relevance of questions.

From a security standpoint, the incorporation of bcrypt hashing for password storage enhances user authentication, preventing unauthorized access and ensuring data integrity. The role-based access control system further strengthens security by allowing only teachers to generate quizzes and lectures, while students are restricted to viewing lectures and attempting quizzes.

A key insight gained from the testing phase was the impact of real-time feedback on student performance. Students who received timely feedback on their quiz attempts showed improved learning outcomes compared to those who only had access to their scores. Incorporating an AI-driven feedback mechanism can enhance the system's ability to provide personalized guidance, helping students identify and rectify their weak areas.

However, some challenges were observed during implementation. While AI-generated MCQs were effective in most cases, contextual inconsistencies arose in some instances, requiring minor manual intervention from teachers. Additionally, response time analysis indicated that query optimization is necessary for improved performance when handling large datasets. These findings highlight the need for further refinements in AI-generated question formulation and database indexing to enhance efficiency.

Overall, the system provides a structured and engaging learning environment, effectively balancing automation with human intervention to optimize the assessment process. The ability to personalize quizzes, secure authentication mechanisms, and structured evaluation features make it a robust solution for digital learning platforms.

Another key benefit of the system is its scalability. Generating MCQs for diverse subjects, making it suitable for academic institutions, corporate training programs, and professional certification courses. The user-friendly design of the web-based interface ensures that educators and students with minimal technical expertise can navigate the system effortlessly.

Moreover, the system fosters a more efficient educational environment by incorporating features such as real-time performance tracking, automated grading, and customizable question difficulty levels. Teachers can tailor quizzes to different learning paces, ensuring that students receive appropriately challenging questions. Future enhancements may include AI-powered adaptive testing, personalized quiz recommendations, and integration with other learning management systems to expand its capabilities.

By implementing a structured login system for teachers and students, the platform ensures efficient content management and assessment delivery. The seamless integration of AI-driven MCQ generation, real-time performance tracking, and accessibility features makes this system a significant advancement over traditional assessment methods. With its focus on automation, accuracy, scalability, and user accessibility, this proposed system sets the foundation for a more inclusive and technology-driven educational framework.

Advantages Over Existing Systems

This system brings a fresh approach to MCQ generation by integrating automation, machine learning, and an easy-to-use interface. It enhances efficiency, accuracy, accessibility, scalability, and usability, making it a valuable tool for both educators and learners.

Increased Efficiency

Creating multiple-choice questions manually can be a tedious and time-consuming task. Traditional methods often require educators to carefully draft questions and answer choices, which is prone to human error. This system automates the entire process, allowing teachers to generate quizzes effortlessly. With AI handling the bulk of the work, educators can dedicate more time to teaching and engaging with students.

Improved Accuracy

Ensuring that MCQs are clear, grammatically correct, and logically structured is crucial for effective assessments. This system uses Natural Language Processing (NLP) to generate high-quality questions along with appropriate answer choices. By eliminating manual errors and inconsistencies, the system helps maintain a high standard of assessment. Additionally, it tailors questions to different levels of complexity, making evaluations fair and comprehensive.

Enhanced Accessibility

Not all students interact with learning material the same way. To make education more inclusive, this system includes pyttsx3, a text-to-speech feature that converts text into audio. This functionality is especially beneficial for visually impaired students, allowing them to listen to quizzes instead of reading them. By providing multiple modes of interaction, the system ensures that learning is accessible to a diverse range of students.

Simple & User-Friendly Interface

Technology should simplify tasks, not complicate them. The system features a Streamlit-based interface, making it easy to navigate even for those with minimal technical skills. With an intuitive layout and responsive design, users can create, manage, and take quizzes with ease. The straightforward functionality ensures that both teachers and students can efficiently use the platform without any unnecessary hurdles.

Proposed Workflow

The proposed system is designed to simplify quiz generation, lecture management, and student assessment through an organized and efficient workflow. The front end of the platform is built using Streamlit, providing an easy-to-navigate interface supported by a role-based login system. Teachers can log in and generate quizzes with the help of Google Gemini AI, upload lecture materials, and evaluate student submissions. On the other hand, students can log in to attempt quizzes, submit their answers, and view lecture content in a read-only format, ensuring a seamless and structured learning environment with distinct roles.

At the heart of the system lies Google Gemini AI, which automates the creation of multiple-choice questions (MCQs). Teachers can either enter a specific topic or upload lecture notes, and the AI processes this input to generate relevant and well-structured questions, complete with distractors. Once the quizzes are generated, they are displayed in real-time on the interface, giving teachers the option to review and refine them before publishing. Additionally, teachers can export the quizzes as PDFs for easy sharing with students. This automated approach not only reduces the time and effort required for quiz creation but also ensures high-quality and relevant content.

The backend of the system is powered by SQLite, which manages vital components such as user authentication, quiz storage, lecture material handling, and student performance tracking. When a student attempts a quiz, their responses are securely stored in the database, enabling teachers to review and assign scores accordingly. Students are also granted read-only access to the lecture materials uploaded by teachers, ensuring that the integrity of the content remains intact while still allowing students to study independently. This secure and organized backend provides a stable foundation for managing both quizzes and learning materials.

Applications

Education: This system revolutionizes the way multiple-choice questions (MCQs) are generated, bringing major advantages to the education sector. By harnessing the power of Natural Language Processing (NLP), it can automatically generate quizzes, exams, and practice tests from any topic or material provided. This automation significantly reduces the time teachers spend preparing assessments while ensuring that the generated questions are accurate, relevant, and aligned with the curriculum. Students benefit from interactive learning experiences, and teachers can redirect their focus toward more effective teaching, reducing the administrative workload.

Training: In corporate and professional settings, this tool can be adapted to generate assessments tailored to specific training programs or roles. Whether it's for onboarding new employees, conducting skills assessments, or supporting continuous professional development, the system can create quizzes that measure knowledge retention and progress. By automating quiz creation, companies save valuable time and resources while ensuring the assessments are both precise and targeted to meet their training goals.

Research: Researchers in academic and scientific fields can take advantage of the system’s ability to automatically generate well-organized questions for surveys, experiments, or any research-driven assessments. The tool helps researchers efficiently create relevant questions based on their field of study, making it easier to design surveys or gather data for experiments. The AI-powered system generates contextually accurate and scientifically relevant questions, enhancing the efficiency of the research process and improving the overall quality of data collection.

V. SYSTEM ARCHITECTURE

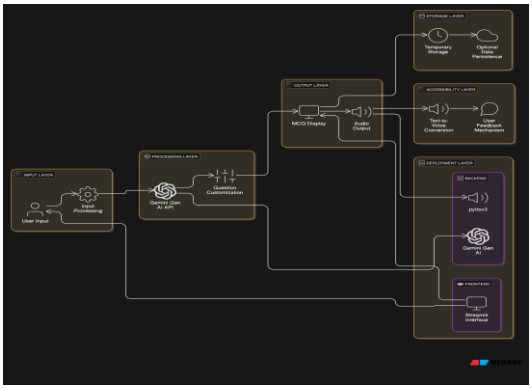

Fig.1. System Architecture

VI. METHODOLOGY

The methodology outlines the systematic process followed to design, develop, and implement the MCQ generation system. The approach integrates cutting-edge AI technologies, user-friendly interface design, and accessibility features to deliver a seamless and efficient solution.

The process begins with data input, where users can either enter a topic, paste specific text, or upload documents via the Streamlit web interface. Once the data is provided, preprocessing is performed to ensure compatibility with the Gemini Gen AI API. This step involves cleaning and formatting the input data to make it suitable for the question generation phase.

For the question generation, the preprocessed input is sent to the Gemini Gen AI API. The system uses natural language processing to create well-formed multiple-choice questions. The result includes the question stem, plausible distractors (incorrect answers), and the correct answer. Users can further customize the question generation by specifying parameters such as difficulty level and domain focus, allowing the system to tailor the questions to specific needs.

The user interface is designed to be minimalistic and intuitive, offering a smooth experience. Through the Streamlit web interface, users can input data, view generated questions in real-time, adjust customization settings, access text-to-speech functionality, and download or export the questions. The interface ensures that the system is simple to navigate, enabling users to quickly engage with its features.

The system follows a clear workflow. Users first input a topic or text, which is processed by the Gemini Gen AI API to generate multiple-choice questions. These questions are then displayed in real-time on the interface. For users who require it, the text is converted to speech for audio output. Finally, users can edit, save, or export the questions as needed.

The system is built with several modules that perform specific functions. The input module captures user inputs, including text or uploaded documents. The processing module is responsible for interacting with the Gemini Gen AI API to generate the questions. The output module displays the generated questions and integrates text-to-speech conversion. The user interface module, based on Streamlit, allows users to interact with the system. The accessibility module ensures that the system is usable by everyone, including those with visual impairments, while the storage module handles temporary or persistent storage of the generated MCQs.

VII. WORKFLOW

The workflow of the proposed system follows a structured process, starting with user input. Users can upload handwritten notes or record/upload an audio file, which are then preprocessed by the system to ensure compatibility with the recognition models. For handwritten notes, the image is passed through a CNN-based recognition module, which extracts the text characters or words. For voice notes, the audio is processed through an NLP-based transcription module, converting the speech into text.

Once the text is extracted from both handwritten and voice notes, it is stored in a unified format. To improve the usability of the notes, contextual tagging and semantic analysis are applied, ensuring that the content is well-organized and easy to interpret.

The system also includes advanced features such as real-time processing and multilingual support, improving the overall user experience. Additionally, secure cloud storage ensures that the notes are accessible and reliable, providing users with a safe and consistent way to manage their data. This design allows the system to meet a wide range of user needs while maintaining performance and security.

VIII. CONCLUSION

The developed system provides an innovative solution for automating the generation of multiple-choice questions (MCQs) using advanced artificial intelligence. The system offers an efficient, accurate, and accessible tool for educators, trainers, and organizations.The system addresses the limitations of existing approaches by.

IX. FUTURE WORK

The current system demonstrates significant potential for automating multiple-choice question (MCQ) generation, but there are several areas where further development can enhance its functionality and impact Expanding the system to include multiple languages would enable it to cater to a wider audience from various linguistic backgrounds. This would make the platform accessible to users in different regions, allowing them to generate MCQs in their preferred language. The ability to adjust the difficulty of questions based on user performance would make the learning experience more personalized.

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About the Authors

Dr. P. R. Sudha Rani received B. Tech degree from Karunya University, Coimbatore, India and the M. Tech and Ph. D in Computer Science and Engineering from Andhra University and ANU respectively. Currently she is a professor at the department of Computer Science and Engineering, Shri Vishnu Engineering College for Women (A), Bhimavaram, Andhra Pradesh, India-534202. Her research interests include algorithm analysis, data mining, cryptography, multimedia encryption, disease correlation analysis, graph theory, optimization techniques, secure software development, data protection strategies, cloud computing infrastructures, machine learning, artificial intelligence in security applications, network security protocols, bioinformatics, and privacy-preserving data analysis.

Ms. Nunna Santhi Priya is an undergraduate student in Computer Science and Engineering from Shri Vishnu Engineering College for Women (A), Bhimavaram, Andhra Pradesh, India-534202. She is keen on the interests of Machine learning, Deep learning, Data Science, and Artificial Intelligence. Her current research areas involve working with machine learning techniques to develop educational tools, particularly a system that uses NLP to automatically generate multiple-choice questions (MCQs). With a solid background in Python she has hands-on experience in creating AI-driven solutions, including platforms that generate quizzes, incorporate voice assistance for visually impaired users, and enhance the overall learning experience.

Ms. Kolla Sasanka is an undergraduate student in Computer Science and Engineering from Shri Vishnu Engineering College for Women (A), Bhimavaram, Andhra Pradesh, India-534202. She is keen on the interests of Machine learning, Deep learning, Data Science, and Artificial Intelligence. Her current research areas involve working with machine learning techniques to develop educational tools, particularly a system that uses NLP to automatically generate multiple-choice questions (MCQs). With a solid background in Python she has hands-on experience in creating AI-driven solutions, including platforms that generate quizzes, incorporate voice assistance for visually impaired users, and enhance the overall learning experience.

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Ms. Mareddy Tejaswini is an undergraduate student in Computer Science and Engineering from Shri Vishnu Engineering College for Women (A), Bhimavaram, Andhra Pradesh, India-534202. She is keen on the interests of Machine learning, Deep learning, Data Science, and Artificial Intelligence. Her current research areas involve working with machine learning techniques to develop educational tools, particularly a system that uses NLP to automatically generate multiple-choice questions (MCQs). With a solid background in Python she has hands-on experience in creating AI-driven solutions, including platforms that generate quizzes, incorporate voice assistance for visually impaired users, and enhance the overall learning experience.

Ms. Medapati Sowmya is an undergraduate student in Computer Science and Engineering from Shri Vishnu Engineering College for Women (A), Bhimavaram, Andhra Pradesh, India-534202. She is keen on the interests of Machine learning, Deep learning, Data Science, and Artificial Intelligence. Her current research areas involve working with machine learning techniques to develop educational tools, particularly a system that uses NLP to automatically generate multiple-choice questions (MCQs). With a solid background in Python she has hands-on experience in creating AI-driven solutions, including platforms that generate quizzes, incorporate voice assistance for visually impaired users, and enhance the overall learning experience.

Ms. Marisetty Surekha is an undergraduate student in Computer Science and Engineering from Shri Vishnu Engineering College for Women (A), Bhimavaram, Andhra Pradesh, India-534202. She is keen on the interests of Machine learning, Deep learning, Data Science, and Artificial Intelligence. Her current research areas involve working with machine learning techniques to develop educational tools, particularly a system that uses NLP to automatically generate multiple-choice questions (MCQs). With a solid background in Python she has hands-on experience in creating AI-driven solutions, including platforms that generate quizzes, incorporate voice assistance for visually impaired users, and enhance the overall learning experience.

Dr. Aaluri Seenu received his B. Tech degree in Computer Science and Engineering from Kakatiya University, India, and the M. Tech and Ph.D. in Computer Science and Engineering from JNTUH and ANU respectively. Currently, he is a Professor in the Department of Computer Science and Engineering at SVECW. His research interests include Data Mining, Neural Networks, Cybersecurity, Secure Software Development, data protection strategies, multimedia encryption, cloud computing infrastructures, algorithm analysis, ethical hacking, network security protocols, emerging programming languages, and artificial intelligence in security frameworks.