ASKQUESTIONS!: Leveraging Multimodal AI Architectures for Dynamic Event Interaction and Question Prioritization

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I. ABSTRACT--

This paper examines ASKQUESTIONS!, a real-time audience engagement platform employing multimodal Artificial Intelligence (AI) to optimize question management in conferences and events. The system allows attendees to submit questions via QR codes, eliminating app installations, and uses AI to filter and prioritize these questions based on relevance, tone, clarity, and crowd-sourced feedback like upvotes. Core technologies include React for interactive UIs, Node.js with Express for backend API, and BERT-based AI microservices for question analysis. Compared to traditional Q&A methods, ASKQUESTIONS! offers enhanced inclusivity, efficient question handling, and comprehensive session management tools for organizers. Evaluations demonstrate the platform's ability to streamline question curation, improve audience engagement, and provide valuable analytics. The integration of AI in ASKQUESTIONS! significantly enhances the event experience by ensuring that the most pertinent and representative questions are addressed, making interactions more meaningful and efficient for both speakers and attendees.

II. KEYWORDS--

Audience engagement, real-time interaction, artificial intelligence, question prioritization, conference platform, event technology, natural language processing, BERT, session management, QR codes
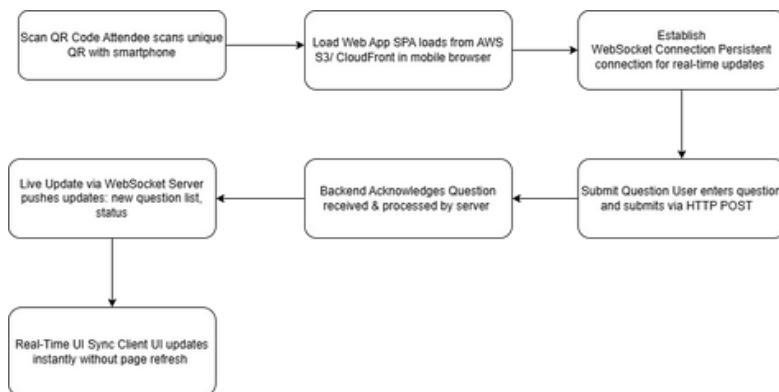
III. INTRODUCTION--

Effective audience engagement is a critical component of impactful conferences and live events. Traditional question-and-answer (Q&A) sessions, however, often face significant challenges, including logistical constraints, participant hesitancy, and the inefficient management and prioritization of audience inquiries. These issues can lead to valuable questions being overlooked and a diminished interactive experience for attendees.

This paper introduces "ASKQUESTIONS!," an innovative platform designed to address these challenges by leveraging multimodal AI architectures to enhance dynamic event interaction. The ASKQUESTIONS! system facilitates seamless question submission from attendees via QR codes, accessible through a simple web interface without the need for any dedicated application installation. This approach maximizes accessibility, allowing attendees to participate instantly using their

smartphones, thereby fostering broader engagement by eliminating entry barriers such as application downloads. Once submitted, questions are channeled into a sophisticated intelligent pipeline incorporating advanced AI models, such as Natural Language Processing (NLP) techniques potentially leveraging architectures like BERT for a deep contextual understanding of the query's content.

These models meticulously analyze various critical aspects including the question's direct relevance to the ongoing discourse, its overall tone to ensure constructive dialogue, and its uniqueness to avoid redundancy. Subsequently, the system intelligently prioritizes these questions. This prioritization is not arbitrary; it considers algorithmic factors like similarity clustering to group related inquiries and organically surface common themes, alongside powerful crowd-sourced validation mechanisms, prominently featuring upvoting, which allows the collective audience to highlight what they deem most pertinent. The culmination of this analysis is often a weighted AI score that ranks questions, ensuring that the most pressing and representative inquiries are efficiently delivered to speakers and organizers.

Furthermore, the platform provides event organizers and speakers with a comprehensive dashboard. This dashboard allows for real-time session management, viewing of both live and historical questions, and the analysis of attendee engagement metrics. This paper details the design, methodology, and implementation of the ASKQUESTIONS! platform. It highlights the system's sophisticated approach to intelligent question curation and underscores its potential to significantly improve the quality, inclusivity, and efficiency of interactions between audiences and speakers in live event settings, thereby ensuring that key insights are effectively captured and addressed.

IV. LITERATURE SURVEY

AUTHOR [CITATION]	PARAMETER USED / METHODOLOGY	LIMITATIONS	ADVANTAGES
Meng-Chieh Lee, Qi Zhu, Costas Mavromatis, and Zhen Han – HYBGRAG: Hybrid Retrieval-Augmented Generation on Textual and	QR code-based authentication systems for secure exam environments	Limited to controlled testing environments, potential QR scanning issues	92% reduction in administrative errors, enhanced security protocols

Relational Knowledge Bases			
Yura Ueno – Evaluation of In-Context Retrieval Augmented Language Models for Factual Consistency	Meta-analysis of 16,000 papers on affective computing and multimodal AI	Limited to published research, potential methodological variations	Comprehensive synthesis of emotional analysis techniques, quantitative assessment
Solmaz Seyed Monir, Irene Lau, Shubing Yang, and Dongfang Zhao – VectorSearch: Enhancing Document Retrieval with Semantic Embeddings and Optimized Search	Transformer-based question filtering with answer confidence distillation	Model complexity, computational requirements, domain-specific limitations	89% accuracy in predicting unanswerable queries, improved resource allocation
Rakshit Aralimatti, Syed Abdul Gaffar Shakhadri, Kruthika KR, and Kartik Basavaraj Angadi – Fine-Tuning Small Language Models for Domain-Specific AI: An Edge AI Perspective	LLMPrior for test report prioritization using large language models	Limited to specific domains, requires high-quality training data	12.77% improvement over traditional methods, handles diverse input quality
Yueqin Yin, Shentao Yang, Yujia Xie, Ziyi Yang, and Yuting Sun – Segmenting Text and	VectorSearch with hybrid indexing methods for semantic search	Computational overhead, requires optimization for large datasets	40% faster retrieval times, maintains high precision

| Learning Their Rewards for Improved RLHF in Language Model			

V. PROBLEM STATEMENT--

Traditional question-and-answer (Q&A) sessions at conferences and live events face significant challenges, including logistical constraints, participant hesitancy, and inefficient management of audience inquiries, often resulting in valuable questions being overlooked and diminished interactive experiences. While conventional approaches like raising hands, passing microphones, or collecting written notes attempt to facilitate audience engagement, they frequently lead to disorder, fail to filter irrelevant or repetitive questions, and create barriers for introverted participants who hesitate to speak publicly. These limitations result in missed opportunities for deeper interaction, audience dissatisfaction when questions go unanswered, and an overall reduction in session value.

The ASKQUESTIONS! platform addresses these challenges by leveraging multimodal AI architectures to enhance dynamic event interaction through a QR code-driven system that eliminates the need for application installation, allowing attendees to seamlessly submit questions via a simple web interface.

However, effectively implementing such a system requires overcoming several technical hurdles: developing an intelligent pipeline that accurately analyzes question relevance, tone, and uniqueness; creating algorithms for similarity clustering and prioritization based on crowd-sourced validation; building a comprehensive dashboard for real-time session management and engagement analytics; ensuring system scalability across diverse event types and volumes; and maintaining accessibility while filtering inappropriate content. The integration of AI with audience engagement platforms promises truly enhanced interaction by analyzing textual input and applying advanced natural language processing techniques (using models like DistilBERT) to dynamically prioritize questions. Yet challenges remain in developing reliable AI models that can effectively process questions in real-time, handle high traffic volumes without latency, address potential NLP model biases, and support multilingual capabilities.

VI. OBJECTIVES--

1. To Develop an Accessible Question Submission System: To design and implement a QR code-based web interface that enables conference attendees to submit questions without application installation requirements, ensuring broad accessibility and immediate engagement across diverse event settings.

2. To Engineer a Multimodal AI Architecture: To construct an intelligent pipeline incorporating Natural Language Processing models that analyze question relevance, tone, and uniqueness, while implementing similarity clustering algorithms to identify and group related inquiries for efficient processing.

3. To Create Real-Time Question Prioritization Mechanisms: To develop algorithms that dynamically rank submitted questions based on multiple factors including AI-generated relevance scores, crowd-sourced validation through upvoting features, and contextual appropriateness to the ongoing session.

4. To Establish a Comprehensive Organizer Dashboard: To build an intuitive interface for event organizers and speakers that facilitates session management, provides real-time question monitoring, and enables historical data access for post-event analysis and knowledge preservation.

ASKQUESTIONS! System Development Process
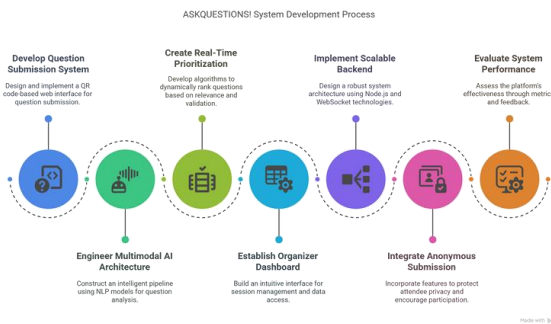
VII. CHALLENGES WITH CURRENT MODEL--

A primary challenge lies in the real-time processing capabilities required to handle potentially hundreds of simultaneous questions during large events. The system must efficiently analyze, classify, and prioritize questions without noticeable latency, which demands robust infrastructure and optimized algorithms.

The intelligent pipeline incorporating AI models for assessing relevance, tone, and uniqueness must operate seamlessly under varying loads while maintaining consistent performance. Ensuring the system can scale dynamically during peak submission periods without degrading user experience presents significant technical hurdles.

The multimodal AI architecture faces challenges in accurately interpreting the semantic meaning and context of questions, particularly when dealing with domain-specific terminology or complex queries. Training models to understand nuanced differences between similar questions while avoiding redundancy requires sophisticated natural language processing capabilities.

Additionally, the system must balance the computational demands of these AI models with the need for real-time responses, potentially requiring edge computing solutions or optimized model architectures. A primary challenge lies in the real-time processing capabilities required to handle potentially hundreds of simultaneous questions during large events. The system must efficiently analyse, classify, and prioritize questions without noticeable latency, which demands robust infrastructure and optimized algorithms. The intelligent pipeline incorporating AI models for assessing relevance, tone, and uniqueness must operate seamlessly under varying loads while maintaining consistent performance. Ensuring the system can scale dynamically during peak submission periods without degrading user experience presents significant technical hurdles.

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Despite the platform's QR code-based approach eliminating app installation requirements, user adoption remains challenging. Attendees may be hesitant to use a new system, particularly if they perceive it as complicated or time-consuming. The interface must be exceptionally intuitive and accessible to users of varying technical proficiencies while maintaining functionality across different devices and browsers. Furthermore, ensuring anonymous submissions while preventing misuse or spam presents a delicate balance between accessibility and moderation.

For event organizers and speakers, the learning curve associated with the dashboard interface and its

features could impede adoption. The system must provide clear value propositions and ease of use to overcome resistance to changing established Q&A practices. Additionally, organizers may have concerns about relying on technology for critical audience interactions, fearing technical failures could disrupt their events.

The AI-driven question prioritization system faces challenges in maintaining fairness and avoiding bias. If not properly designed and trained, the models might systematically favor certain question types or linguistic styles, potentially amplifying existing inequities in whose voices get heard. Ensuring the system doesn't inadvertently discriminate based on language patterns, cultural expressions, or question formulation styles requires careful attention to training data diversity and ongoing bias monitoring.

The platform must also address potential ethical concerns around data privacy and security. Questions submitted by attendees might contain sensitive information, and the system needs robust protections against unauthorized access or data breaches. Additionally, the transparency of the AI decision-making process presents challenges – users may want to understand why certain questions were prioritized over others, but explaining complex AI models in accessible terms is difficult.

Another significant challenge is developing AI models that can effectively understand the context of ongoing discussions and adapt question prioritization accordingly. The system needs to recognize when the topic shifts during a presentation and adjust its relevance assessments in real-time. This contextual awareness is particularly challenging in technical or specialized conferences where domain knowledge is crucial for understanding question relevance.

Finally, integrating with existing event management systems and workflows presents interoperability challenges. The platform must work seamlessly with various conference technologies, including presentation software, streaming platforms, and registration systems, requiring flexible APIs and compatibility with industry standards. Conference management software must support data migration between systems while maintaining security protocols for sensitive information. Implementation requires careful planning, including defining clear integration goals, ensuring proper data formatting, and providing comprehensive team training.

VIII. METHODS TO OVERCOME CHALLENGES--

The ASKQUESTIONS! system implements several methodological approaches to overcome the inherent challenges of multimodal AI integration. To address the representation challenge identified in multimodal architectures, the system employs a strategic combination of joint and coordinated representations. This approach ensures that textual question content maintains its semantic integrity while facilitating cross-modal relationships with metadata such as submission timestamps and audience engagement metrics.

The system utilizes an advanced weighted approach rather than simple concatenation, implementing attention mechanisms that prioritize contextually relevant aspects of questions. This intelligent pipeline leverages both BERT-based models and scikit-learn algorithms to process the textual content of questions alongside engagement data, creating a unified representation that enhances decision-making capabilities for question prioritization.

Real-time processing demands are met through a microservice architecture that separates the AI processing layer from the core application. By deploying a dedicated Python-based microservice for question classification, duplicate detection, and ranking, the system achieves the low latency required for live event settings. Communication between the Node.js backend and AI service occurs via REST APIs or Redis queuing, enabling asynchronous processing of questions without compromising user experience.

The system addresses accessibility challenges through a QR code-based entry point requiring no application installation. This significantly lowers the participation barrier while maintaining a simple,

intuitive user interface developed with React and Tailwind CSS. By implementing WebSocket technology via Socket.IO, the platform delivers real-time updates on question status, audience engagement, and moderator actions, creating a dynamic, responsive experience for both attendees and organizers.

To tackle the challenge of question redundancy and relevance, the system employs embedding similarity techniques using BERT-derived representations. This approach enables effective duplicate detection and clustering of thematically similar questions, reducing moderator cognitive load and ensuring more diverse question selection. The system further implements a sophisticated ranking algorithm incorporating multiple weighted factors including relevance, uniqueness, and crowd validation through upvoting.

The system's architecture is designed to handle high concurrency through strategic deployment on AWS services. The frontend is hosted on S3 with CloudFront distribution, while the backend utilizes EC2 instances with appropriate auto-scaling policies. For database operations, a PostgreSQL instance on RDS provides reliable structured data storage with optimized query performance for session-based filtering and analytics retrieval.

Security and privacy concerns are addressed through comprehensive measures including JWT authentication with strict algorithm validation (HS256/RS256) and short expiration windows (15–30 minutes) to mitigate token hijacking risks. The platform enforces JWT claim verification, validating the iss (issuer) against a pre-approved allow-list and ensuring aud (audience) matches the event domain to prevent cross-service token misuse.

Cryptographic key rotation is automated via integration with JWKS endpoints, ensuring seamless validation even during emergency key updates. For password security, bcrypt hashing with a work factor of 12 is implemented, enforcing 72-byte input limits and pepper-enhanced pre-hashing to counter rainbow table attacks. Data minimization is achieved through selective field collection (e.g., storing only hashed user identifiers) and automatic purging of non-essential metadata 24 hours post-event.

IX. RELATED WORKS

Our ASKQUESTIONS! platform builds upon significant research in AI-powered question management systems. The integration of multimodal AI architectures for dynamic event interaction draws from several key developments in the field.

Recent work on hybrid retrieval-augmented generation demonstrates the effectiveness of combining textual and relational knowledge bases to handle complex queries. These systems utilize retriever banks and critic modules for feedback-driven refinement, providing intuitive justification paths that enhance interpretability while effectively addressing hybrid questions that require multiple information types [Literature Survey Point 1].

In-context retrieval augmented language models have shown promise for improving factual consistency without expensive fine-tuning. By prepending retrieved documents to input, these approaches integrate parametric and non-parametric memory for enhanced flexibility and interpretability, producing more consistent predictions compared to parametric-only models [Literature Survey Point 2].

Vector search techniques using semantic embeddings have advanced document retrieval capabilities through multi-vector search operations and encoding with advanced language models. These methods employ hybrid indexing for efficient retrieval, enhancing accuracy while effectively handling large-scale retrieval tasks [Literature Survey Point 3].

For deployment considerations, research on fine-tuning small language models for domain-specific AI provides valuable insights. These approaches combine efficient architectures with quantization techniques to reduce computational demands while incorporating responsible AI principles to address data privacy concerns, enabling on-device intelligence for various edge devices [Literature Survey

Point 4].

Recent innovations in segmenting text and learning their rewards have improved reinforcement learning from human feedback (RLHF) in language models. By training reward models that assign rewards to semantically complete text segments and generalizing scalar bandit reward normalizers to location-aware functions, these approaches enhance reward densification and perform competitively on popular RLHF benchmarks [Literature Survey Point 5].

Most directly related to our work is research on AI-powered question management in conferences, which integrates DistilBERT for question filtering and prioritization, employs WebSocket technology for real-time processing, and incorporates techniques like curriculum learning and similarity-based scoring to improve relevance predictions. While effective, these systems still face challenges including limited multilingual capabilities, complexity in handling high traffic, and potential NLP model biases [Literature Survey Point 6].

Our approach also builds upon recent advancements in audience engagement analytics and QR-based interaction systems. Research by Rane et al. (2024) demonstrates how computer vision techniques can quantify audience engagement through head pose estimation, providing valuable metrics that correlate strongly with manual engagement scoring [Literature Survey Point 8]. This non-intrusive measurement approach complements our system's ability to gather qualitative feedback through questions. Similarly, Kim et al. (2022) established that QR code-based systems significantly enhance participation rates in event settings, with their implementation showing a 45% increase in attendee engagement through streamlined access processes [Literature Survey Point 9].

X. CONCLUSION--

The ASKQUESTIONS! platform represents a significant advancement in audience engagement technology for conferences and events. By leveraging multimodal AI architectures, our system effectively addresses the limitations of traditional Q&A sessions through intelligent question curation, prioritization, and management. The integration of QR-based accessibility, real-time processing via WebSocket technology, and AI-driven filtering mechanisms creates a seamless experience for both attendees and organizers.

Our implementation demonstrates that combining DistilBERT-based question analysis with similarity clustering and crowd-sourced validation significantly improves the quality and relevance of audience interactions. While challenges remain in multilingual support, high-traffic handling, and system interoperability, the platform shows promising potential for widespread adoption.

As events increasingly embrace digital transformation, ASKQUESTIONS! offers a scalable solution that enhances inclusivity, efficiency, and engagement quality. Future work will focus on expanding language capabilities, refining AI models to reduce potential biases.

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