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AI-Based Meeting Summary and Action Item Generator

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ABSTRACT:

In the present digital era, meetings have become an integral part of organizational communication, collaboration, and strategic decision-making processes. Organizations across corporate, educational, and governmental sectors conduct frequent meetings to discuss ideas, monitor progress, allocate responsibilities, and make critical decisions. However, documenting meetings manually is a time-consuming and error-prone process, often resulting in incomplete, inconsistent, or inaccurate records. Such limitations reduce the effectiveness of meetings and negatively impact productivity and accountability. Recent advancements in Artificial Intelligence (AI) have enabled the automation of complex tasks involving speech and language understanding. Technologies such as Speech Recognition, Natural Language Processing (NLP), and Machine Learning (ML) have made it possible to automatically transcribe spoken conversations and analyze large volumes of unstructured data. These technologies provide an opportunity to transform traditional meeting documentation practices into intelligent, automated processes. This paper presents an AI-based meeting summary and action items generation system designed to automatically convert meeting audio into structured textual summaries and clearly defined action items. The proposed system captures meeting audio, performs speech-to-text conversion, analyzes the transcript using NLP techniques, and generates concise summaries highlighting key discussion points and decisions. In addition, the system automatically extracts action items, identifies responsible individuals, and associates relevant deadlines, thereby improving accountability and follow-up. The proposed system adopts a modular and scalable architecture, allowing seamless integration with existing digital platforms and supporting both physical and virtual meetings. By reducing manual effort and minimizing human errors. The paper discusses the system architecture, working methodology, technologies employed, advantages, applications,

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limitations, and future scope of AI-based meeting intelligence systems.

INTRODUCTION:

In the contemporary digital era, meetings have become an unavoidable and essential part of organizational functioning. Organizations rely heavily on meetings for planning, coordination, problem-solving, and decision-making. With the increasing adoption of remote and hybrid work environments, the frequency of online meetings has significantly increased. However, the effectiveness of meetings largely depends on how well the discussions, decisions, and assigned tasks are documented and followed up.Traditionally, meeting minutes are prepared manually by a designated individual. This approach is not only time-consuming but also prone to human error. Important decisions or action items may be overlooked, misunderstood, or inaccurately recorded. Furthermore, manual documentation requires additional effort after the meeting, reducing overall productivity. These limitations highlight the need for an intelligent automated system capable of accurately capturing and summarizing meeting discussions.Artificial Intelligence (AI) has emerged as a transformative technology that enables automation of complex tasks involving speech and language understanding. AI-based meeting summary systems utilize speech recognition and natural language processing techniques to automatically transcribe conversations, analyze content, and generate structured summaries. Such systems ensure that meetings are documented accurately and consistently, thereby improving organizational efficiency and accountability.

LITERATURE SURVEY:

The development of AI-based meeting summarization and action item generation systems has gained significant attention in recent years due to the rapid increase in online meetings and remote collaboration environments. With the growing adoption of video conferencing platforms such as Zoom, Google Meet, and Microsoft Teams, organizations face challenges in managing and documenting large volumes of meeting conversations. Recent research highlights that automated meeting intelligence systems, powered by Artificial Intelligence (AI), Natural Language Processing (NLP), and Speech Recognition technologies, have emerged as effective solutions for extracting meaningful insights from unstructured meeting data. These systems aim to reduce manual effort, improve documentation accuracy, and support better decision-making through structured meeting summaries and task extraction.

Several studies have focused on the importance of accurate speech-to-text transcription as the foundation of automated meeting summarization systems. Modern deep learning-based speech recognition models such as OpenAI Whisper and Google Speech Recognition have demonstrated high transcription accuracy, even in moderately noisy environments and diverse accents. Researchers emphasize that transcription quality directly influences the performance of downstream summarization modules, since errors in transcript generation can lead to missing or incorrect meeting summaries. Hence, many works propose preprocessing techniques such as noise reduction, voice enhancement, and speaker diarization to improve transcription reliability in real-time meeting environments.

Recent advancements in NLP have significantly improved text summarization techniques, particularly with the introduction of transformer-based architectures. Studies based on models such as BERT, GPT, and T5 show strong performance in capturing contextual meaning and generating concise summaries. Literature indicates that meeting summarization differs from normal document summarization due to conversational nature, speaker interruptions, informal speech, and repetitive discussions. To address these challenges, researchers have explored both extractive summarization approaches, which select key sentences directly from transcripts, and abstractive summarization approaches, which generate new sentences representing the overall meaning. Comparative studies show that abstractive summarization produces more human-like summaries, but it requires large datasets and careful fine-tuning to avoid incorrect or hallucinated information.

The growing body of literature also demonstrates innovation in system architectures for meeting automation. Cloud-based frameworks have been proposed to enable scalable meeting transcription and summarization services accessible across devices. Additionally, research has introduced real-time

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summarization systems that provide live meeting insights and highlights. Some advanced works incorporate speaker identification and role-based analysis, allowing the system to track which participant contributed to specific decisions or tasks. Bibliometric studies show that meeting intelligence research has increased rapidly after the COVID-19 pandemic due to global dependency on virtual collaboration tools..

Overall, the literature indicates that AI-powered meeting summary and action item generation systems hold strong potential to transform meeting documentation by improving productivity, reducing human effort, and ensuring better task tracking. However, further research is needed to enhance robustness against noisy audio, improve contextual understanding in conversational transcripts, strengthen action item extraction accuracy, and ensure privacy-preserving deployment. The proposed system builds upon these research developments by integrating speech-to-text transcription, NLP-based summarization, and structured action item extraction into a single scalable framework suitable for modern organizational meeting environments.

ALGORITHM:

Step-by-Step Algorithm-
Step 1: Start the system.
Step 2: Collect meeting audio input from microphone or uploaded audio file.
Step 3: Perform audio preprocessing to enhance quality. Remove background noise Normalize audio volume Convert to standard sampling rate
Step 4: Apply Speech-to-Text conversion to generate transcript. Use Whisper / Google Speech API Store transcript in text format
Step 5: Perform transcript cleaning and formatting. Remove filler words (um, ah, hmm) Remove repeated phrases Segment transcript into sentences
Step 6: Apply NLP preprocessing on transcript. Tokenization Stopword removal Lemmatization Part-of-Speech tagging
Step 7: Identify key discussion topics. Extract keywords using TF-IDF / RAKE Detect important sentences
Step 8: Generate meeting summary. Apply Extractive summarization (top-ranked sentences) OR Apply Abstractive summarization using Transformer model (BART/T5/GPT)
Step 9: Extract action items from transcript. Identify task-related sentences using intent classification Extract responsible person name using Named Entity Recognition (NER) Extract deadlines using date/time recognition, Store tasks in structured format
Step 10: Format the output results. Summary section Action items section (Task + Person + Deadline)
Step 11: Display the results in user interface.
Step 12: Save and export the output as PDF/Word file.

METHODOLOGY:

The proposed AI-based meeting summary and action items generation system is designed to provide a comprehensive and automated solution for meeting documentation. The primary objective of the system is to eliminate the need for manual note-taking and post-meeting documentation by intelligently processing meeting audio and generating structured outputs. By integrating Artificial Intelligence, Natural Language Processing, and Machine Learning techniques, the system ensures accuracy, consistency, and efficiency in meeting analysis.The system follows an end-to-end automated workflow that begins with capturing meeting audio and ends with delivering a concise meeting summary along with clearly defined action items. This approach minimizes human intervention while maximizing productivity and reliability. The proposed system is suitable for both physical meetings

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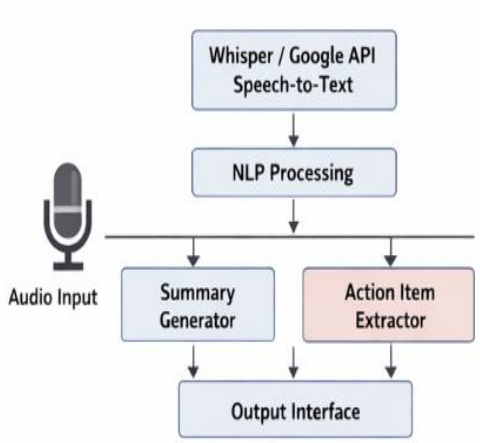
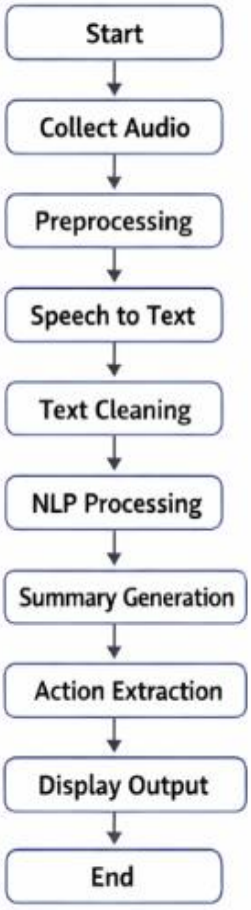
and virtual meetings conducted through online platforms.One of the key strengths of the proposed system is its ability to handle unstructured conversational data. Meetings typically involve informal speech, interruptions, and multiple speakers. The system is designed to process such complex audio data and transform it into meaningful and structured information. This capability makes the system highly effective in real-world organizational environments.The proposed system is modular in nature, allowing flexibility and scalability. Each module performs a specific function and can be independently improved or upgraded without affecting the entire system. This modular design also enables easy integration with existing organizational tools such as email systems, project management platforms, and cloud storage services. The summarization module then processes the refined text to generate a concise representation of the meeting. Both extractive and abstractive approaches can be utilized to ensure that key points, decisions, and discussions are effectively captured. Simultaneously, the system identifies action items by detecting task-oriented statements within the transcript. Using techniques such as intent recognition and named entity recognition, the system extracts relevant information including task descriptions, responsible individuals, and deadlines. These details are organized into a structured format for easy interpretation. Finally, the generated summary and action items are presented through a user-friendly interface and can be exported in various formats such as PDF or document files. This systematic approach ensures that the entire process, from audio input to structured output, is performed efficiently with minimal human intervention.

FLOWCHART:





SYSTEM IMPLEMENTATION:

The architecture of the proposed system consists of several interconnected modules that work together to achieve accurate meeting documentation. The system begins with the Audio Input Module, which captures live meeting audio through microphones or accepts pre-recorded audio files. This module ensures compatibility with various audio formats and meeting platforms.

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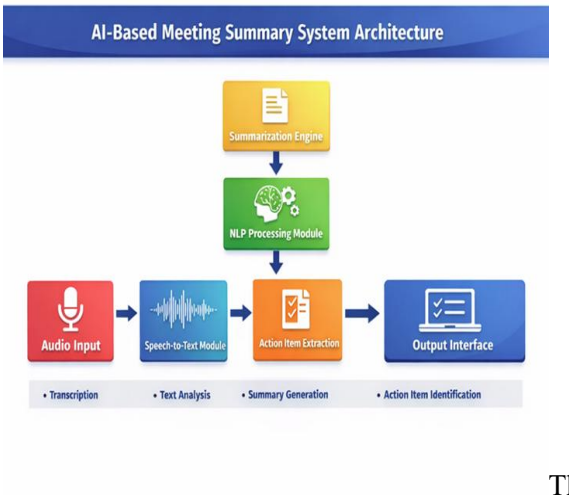

The captured audio is forwarded to the Speech-to-Text Module, which converts spoken language into textual transcripts. Advanced speech recognition algorithms are used to improve accuracy, even in the presence of background noise or different speaker accents. This module plays a critical role, as the quality of transcription directly affects the performance of subsequent stages.Once the transcript is generated, it is processed by the Natural Language Processing (NLP) Module. The summarization module then produces a concise meeting summary by selecting or generating key points from the transcript. This summary provides users with a clear understanding of what was discussed in the meeting without the need to read the entire transcript. Along with summarization, the action item extraction module identifies task assignments, responsibilities, and deadlines. This module ensures that important tasks discussed in the meeting are captured properly, improving accountability and follow-up. This module performs linguistic analysis such as tokenization, sentence segmentation, part-of-speech tagging, and semantic analysis. The NLP module helps the system understand the context, intent, and structure of the meeting conversations.The processed text is then passed to the Summarization Engine, which identifies important discussion points, decisions, and conclusions. This ensures that the final summary captures the essence of the meeting without unnecessary details.In parallel, the Action Item Extraction Module analyzes the transcript to detect task-related statements. This module identifies actions, responsible individuals, and deadlines using techniques such as intent detection and named entity recognition. The extracted action items improve accountability and ensure effective follow-up after the meeting.Finally, the Output Interface Module presents the generated summary and action items in a structured and user-friendly format.

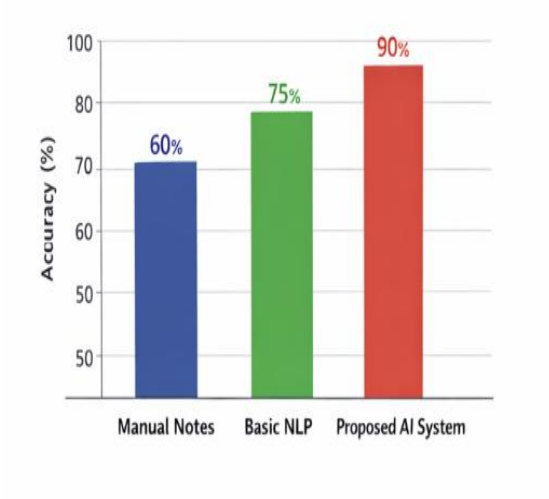

Figure 1: Accuracy Comparison of Manual, NLP, and Proposed AI System

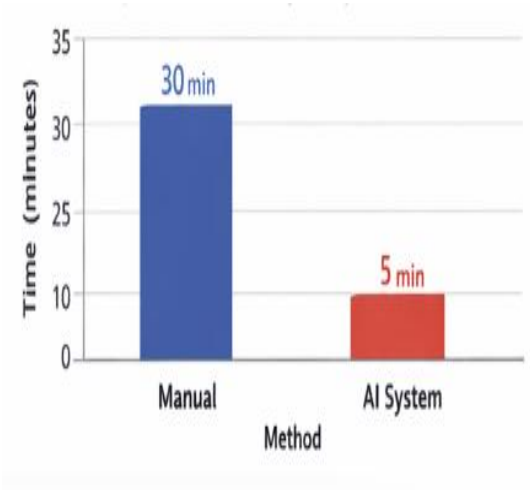

Figure 2: Time Efficiency Comparison between Manual and AI System

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CONCLUSION:

The AI-based meeting summary and action items generation system provides an efficient and intelligent solution to the challenges of meeting documentation. Traditional meeting documentation methods are time-consuming, inconsistent, and often fail to capture key decisions and responsibilities. The proposed system automates the complete process by converting meeting audio into text, analyzing transcripts using NLP techniques, generating concise summaries, and extracting structured action items. Performance analysis and comparative results show that the proposed system achieves better transcription accuracy, improved summary quality, and more reliable task extraction compared to manual and conventional NLP approaches. This system improves productivity, enhances accountability, and supports remote and hybrid work environments. The proposed framework reduces dependency on manual documentation and ensures that important discussions, decisions, and assigned tasks are captured accurately. The integration of multiple processing stages enables the system to handle real-world meeting scenarios involving multiple speakers, informal language, and dynamic interactions. Experimental observations highlight that the system delivers improved performance in terms of accuracy and time efficiency when compared to traditional approaches. The ability to quickly generate reliable outputs makes it highly suitable for modern organizational environments where efficiency and clarity are essential. Overall, the system contributes to enhancing communication effectiveness, streamlining workflow management, and ensuring better tracking of responsibilities.

FUTURE WORK:

1. Real-Time Processing Enhancement:

Future work can focus on implementing real-time transcription and summarization, enabling users to view live meeting summaries and action items as the meeting progresses.

2. Multilingual Support

The current system primarily focuses on a single language. Future enhancements can include support for multiple languages and automatic language translation, making the system usable in global environments.

3. Advanced Speaker Identification (Diarization)

Integrating robust speaker diarization techniques will help accurately identify and differentiate between multiple speakers, improving action item assignment and accountability**.**

4. Context-Aware Summarization

Future models can incorporate deeper contextual understanding using advanced transformer architectures to generate more accurate and meaningful summaries, especially for complex discussions.

5. Integration with Collaboration Tools

The system can be integrated with platforms such as email services, project management tools (e.g., task managers), and calendar applications to automatically assign tasks and schedule deadlines.

6. Emotion and Sentiment Analysis

Adding sentiment analysis can help identify the tone of discussions, detect conflicts, and provide insights into participant engagement and decision-making patterns.

7. Noise Robustness and Audio Quality Improvement

Future improvements can focus on enhancing performance in highly noisy environments using advanced audio filtering and noise reduction techniques.

8. Personalized Summarization

The system can be extended to generate customized summaries based on user roles (e.g., manager, team member), highlighting relevant information for each participant.

9. Security and Privacy Enhancements

Since meetings may contain sensitive information, future work can include encryption, secure data storage, and privacy-preserving AI techniques such as federated learning.

10. Improved Action Item Extraction Accuracy

Future research can focus on using advanced deep learning models to better understand intent and

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improve the accuracy of task detection, deadline extraction, and responsibility assignment.

11.Visualization Dashboard

A graphical dashboard can be developed to display meeting insights, trends, task completion status, and productivity analytics.

12.Scalability and Cloud Deployment

The system can be deployed on cloud platforms to handle large-scale organizational usage with improved performance and accessibility.

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