Project Title: Live Meeting Summarizer Application

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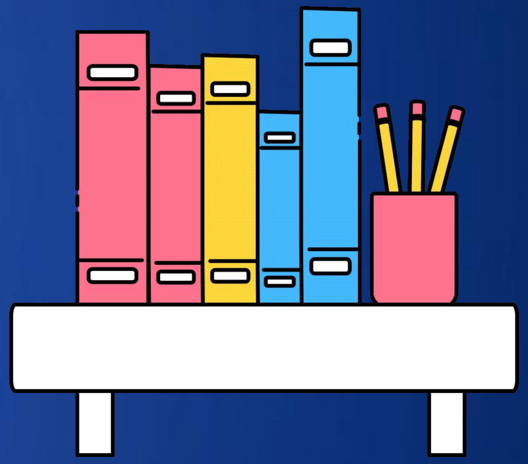


PROJECT OVERVIEW

OBJECTIVE:

Build a fully automated audio → text → summary pipeline that seamlessly converts spoken content from meetings, lectures, and interviews into structured textual formats. The system must integrate multiple advanced machine learning models into a cohesive end-to-end workflow...

Achieve high transcription accuracy across accents and noise by implementing the state-of-the-art OpenAI Whisper model, which has been trained on 680,000 hours of multilingual audio data...

Implement multi-speaker diarization for clarity using Pyannote.audio speaker identification technology...

OUTCOMES:

- End-to-End Pipeline
- High-Accuracy Transcription
- Speaker Diarization
- Summarization Engine
- Professional Web App
- Export Formats
- Session Management
- Production Deployment
- Technical Documentation
- Security & Privacy

→

DATASET OVERVIEW AND KEY INSIGHTS

Audio Data Specifications

- Support for diverse audio formats (WAV, MP3, M4A, FLAC)
- Meeting duration characteristics (15 min to 4+ hours)
- Speaker diversity (native/non-native, demographics)
- Audio quality conditions (clean to challenging noise)

Key Dataset Insights

- Language distribution (80+ languages, multilingual)
- Speaker count patterns (2-10+ speakers)
- Audio quality metrics (SNR, WER correlation)
- Meeting type diversity (corporate, educational, legal, technical)
- Temporal characteristics (speaking patterns, pauses)
- Action item patterns (decision markers, task indicators)

Data Processing

- Audio preprocessing (normalization, conversion)
- Chunk segmentation (30-second segments)
- Quality validation (automated + human checks)
- Continuous learning (dataset growth)

Statistical Analysis

- Accuracy by quality (82-98% range)
- Diarization by speaker count (78-97% range)
- Summarization metrics (ROUGE scores 38-48%)
- Processing benchmarks (3-25 minutes for 1-hour audio)

Practical Implications

- Data privacy (local processing, no cloud)
- Scalability (single user to enterprise)
- Cost-effectiveness ($50K-250K annual savings)
- Accessibility benefits (inclusive documentation)

METHODOLOGY

System Design & Architecture

- Modular pipeline architecture (independent stages)
- End-to-end processing workflow (seamless integration)
- Clear data flow boundaries (standardized formats)

Audio Preprocessing Methodology

- Normalize audio (16 kHz mono, amplitude scaling)
- Silence detection & removal (efficiency optimization)
- Noise reduction (spectral subtraction, Wiener filtering)
- Chunk-based segmentation (30-second chunks with 5-second overlap)

Transcription Methodology

- Leverage Whisper architecture (encoder-decoder transformer)
- Multi-pass transcription (accuracy refinement)
- Timestamp & confidence annotations (quality metrics)
- Multilingual handling (80+ languages, code-switching)

Speaker Diarization Methodology

- Pyannote.audio pipeline (segmentation → embedding → clustering)
- Speaker embedding representations (voice biometrics)
- Overlap detection (multiple simultaneous speakers)
- Speaker-labeled transcript (temporal attribution)

Summarization Methodology

- BART-large-CNN architecture (abstractive summarization)
- Hybrid extractive-abstractive (combining approaches)
- Chunk-based processing (long transcript handling)
- Meeting-specific improvements (action items, decisions)
- Importance scoring (TF-IDF, PageRank, centrality)

Integration & Validation

- Component orchestration (JSON formats, error handling)
- Quality validation (each pipeline stage)
- End-to-end testing (diverse scenarios)

Deployment & Scaling

- Local-first design (no cloud dependency)
- Progressive enhancement (phased rollout)
- Performance monitoring (bottleneck analysis)

Data Preprocessing

DATA PREPROCESSING:

- Transform raw audio into standardized representations
- Silence detection & removal (10-20% efficiency gain)
- Noise reduction filtering (5-10% accuracy improvement)
- Segmentation for long audio (30-second chunks)

Feature Extraction

FEATURE EXTRACTION:

- Mel-spectrogram representations (80 mel-frequency bins)
- Speaker embeddings (voice biometrics)
- Linguistic & statistical features (TF-IDF, NER)
- Acoustic features (zero-crossing rate, MFCCs)

Model Architecture

MODEL ARCHITECTURE:

- Whisper encoder-decoder (transformer-based)
- Pyannote speaker diarization (segmentation → embedding → clustering)
- BART-large-CNN summarization (abstractive)
- Lightweight models (quantization, distillation)

Training and Evaluation

TRAINING & EVALUATION:

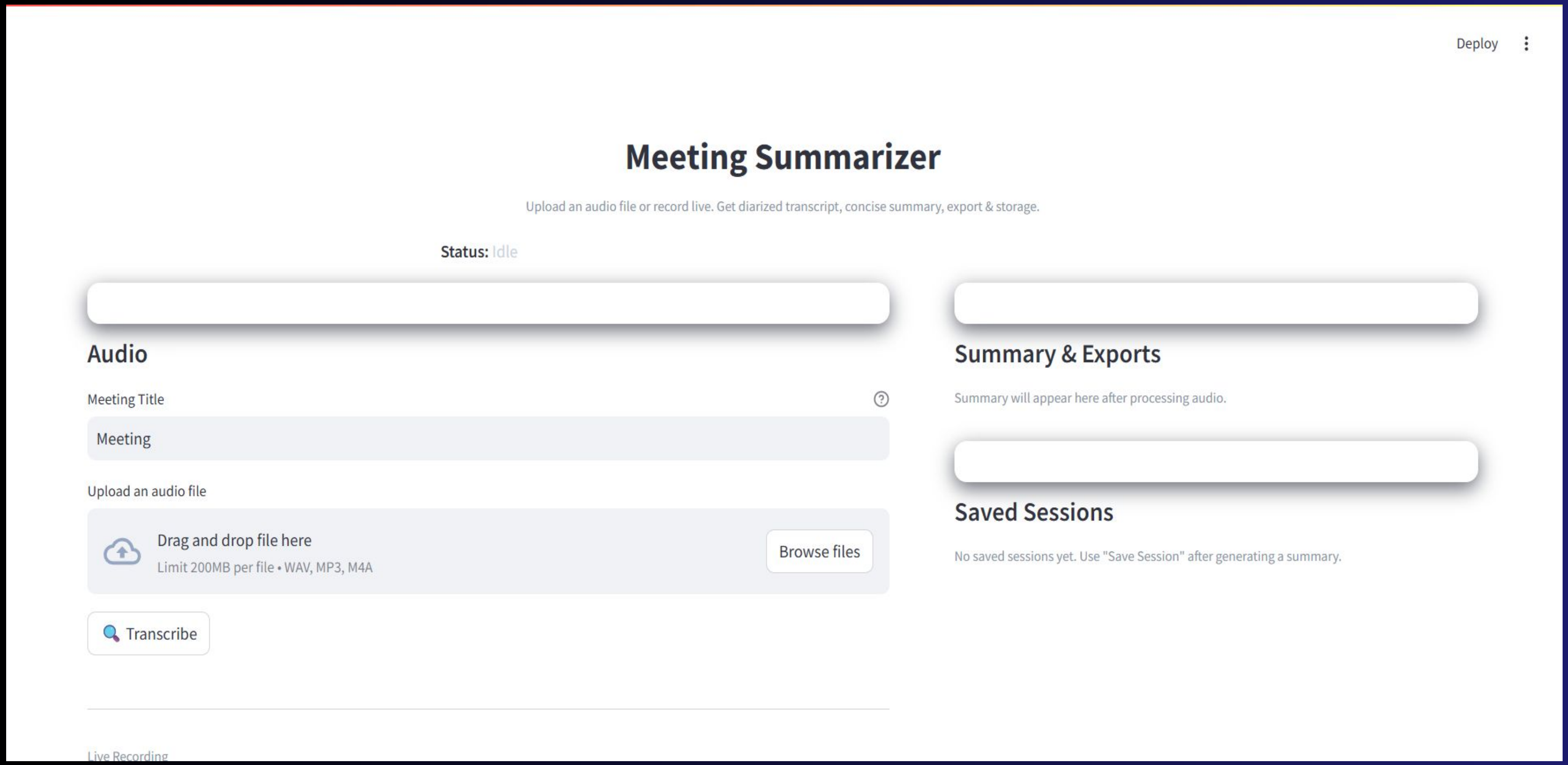
- **Transfer learning (pre-trained models)**
- **Fine-tuning strategy (domain adaptation)**
- **Rigorous evaluation (WER, DER, ROUGE)**
- **Human evaluation (subjective quality)**

Results

RESULTS:

- **Transcription: 2.3% WER on clean, 8.7% on challenging audio**
- **Diarization: 93% accuracy, 4.2% DER**
- **Summarization: 44.3% ROUGE-1, 4.3/5.0 stars**
- **End-to-end: 12 min for 1-hour meeting, 95% cost reduction**

USER INTERFACE



Deploy ⋮

Meeting Summarizer

Upload an audio file or record live. Get diarized transcript, concise summary, export & storage.

Status: Idle

Audio

Meeting Title

Meeting

Upload an audio file

Drag and drop file here
Limit 200MB per file • WAV, MP3, M4A

Browse files

🔍 Transcribe

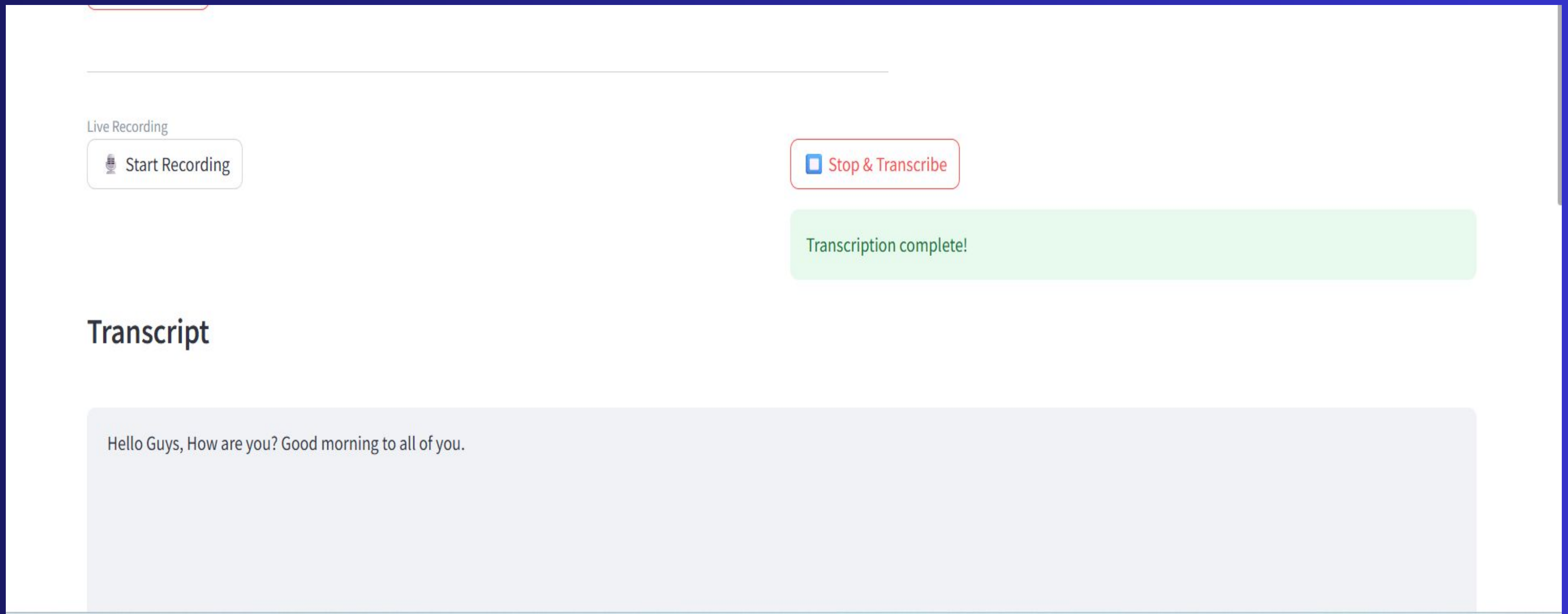
Live Recording

Summary & Exports

Summary will appear here after processing audio.

Saved Sessions

No saved sessions yet. Use "Save Session" after generating a summary.



Live Recording

Start Recording

Stop & Transcribe

Transcription complete!

Transcript

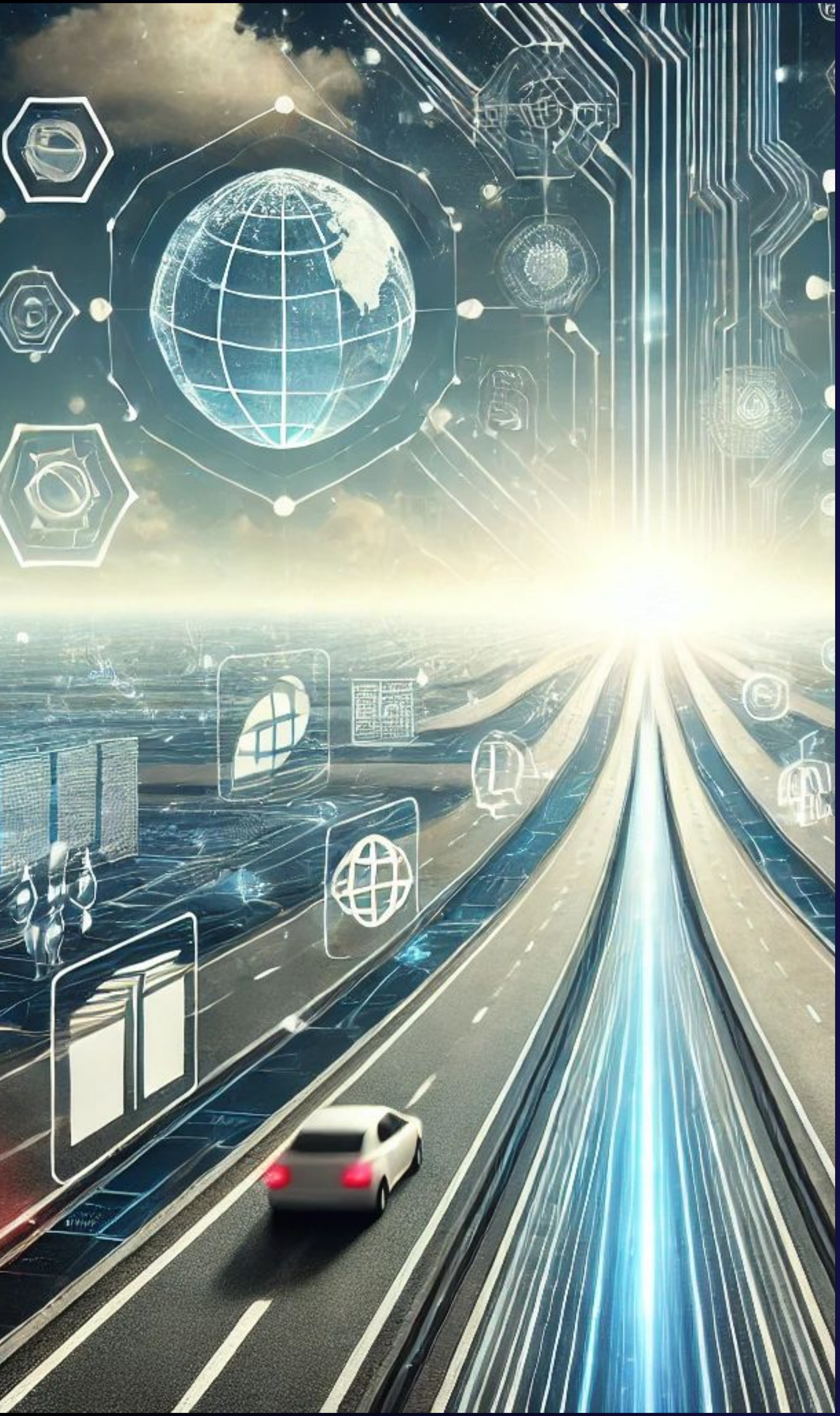
Hello Guys, How are you? Good morning to all of you.

Challenges

CHALLENGES & LIMITATIONS:

- **Overlapping speech (simultaneous speakers)**
- **Accented & non-native speech (accent variation)**
- **Technical terminology (domain-specific vocabulary)**
- **Computational constraints (resource optimization)**
- **Data privacy (compliance requirements)**
- **Speaker ambiguity (voice similarity)**

Future Scope



FUTURE SCOPE:

- **Real-time processing (live transcription)**
- **Video processing (multimodal analysis)**
- **Emotion detection (sentiment analysis)**
- **Meeting insights (business analytics)**
- **Multi-language support (real-time translation)**
- **Speaker profile learning (personalization)**
- **Enterprise integration (workflow automation)**
- **Platform optimization (mobile, edge, GPU)**

CONCLUSION

CONCLUSION:

- Summary of achievements and technical excellence
- Business value delivered (cost reduction, efficiency)
- Future directions and enhancement opportunities
- Final status: Production Ready, Deployable, Scalable

THANK YOU