

STEMMY



OUR TEAM



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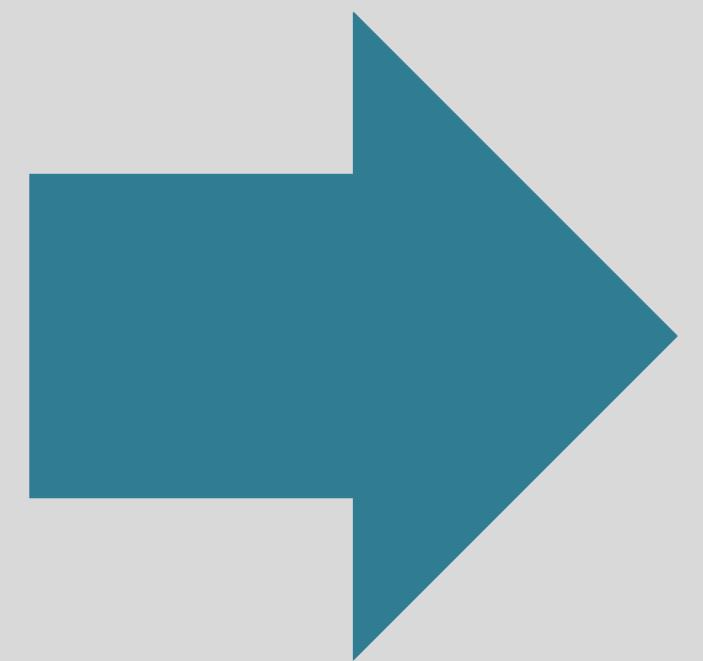
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Problem & Solution

PROBLEM

- Traditional STEM education tools often lack emotional awareness and adaptability.
- Students with speech or hearing impairments face accessibility challenges in learning environments.
- STEM concepts are often delivered in a dry, non-engaging manner.

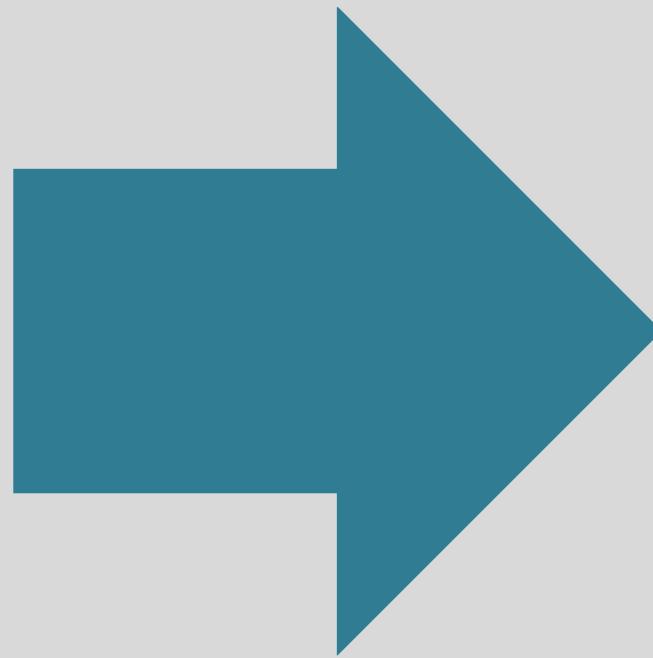


SOLUTION

Developed a multi-modal AI assistant (STEMMY) that integrates:



- Speech-to-text conversion for real-time verbal input.
- Sign language model detection for inclusive communication.
- Adapts responses based on user's mode of communication and emotional state.



Key features



- Supports multi-modal interaction:
 1. Speech-to-text for voice input
 2. sign language recognition
 3. YOLO-based facial emotion detection
 4. Generating Images for easy learning
- Delivers personalized and emotionally-aware responses
- Enhances accessibility and engagement in STEM learning

TECHNOLOGY USED

FRONT END

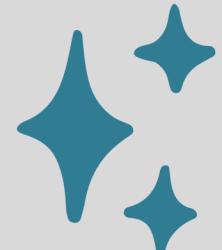
- HTML
- CSS
- Java Script

By using React

MODELS USED

- YOLO
- RAG
- BERT
- Microsoft model
- Classification Transformer
- GAN

Results



- Speech-to-Text Model

-Effective for general STEM speech input; potential for further improvement via fine-tuning

Accuracy: 73.5%

- STEM Subject Classifier

-Accurately distinguishes Math vs. Science, and Physics vs. CS.

Accuracy: 80.36%

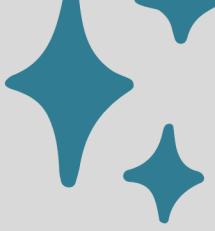
Weighted F1-score: 80.42%

- Humor Detection (Transformer-based)

-Detects humorous in responses.

Accuracy: 94.33%

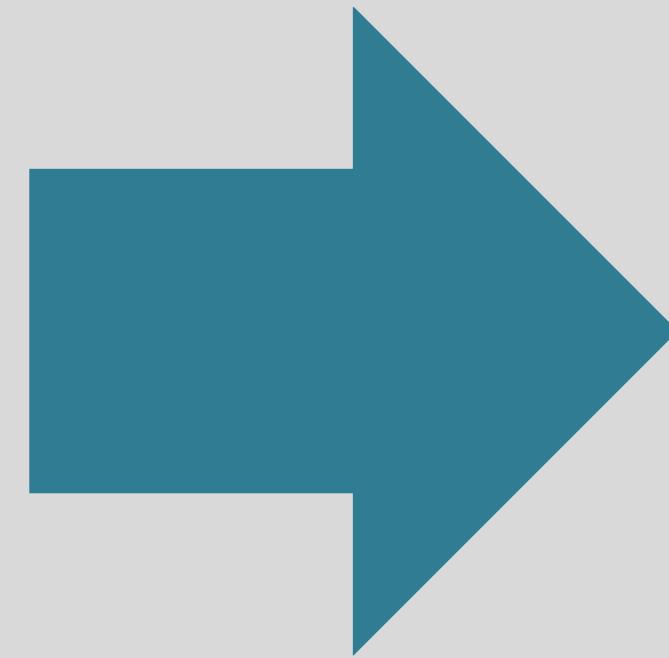




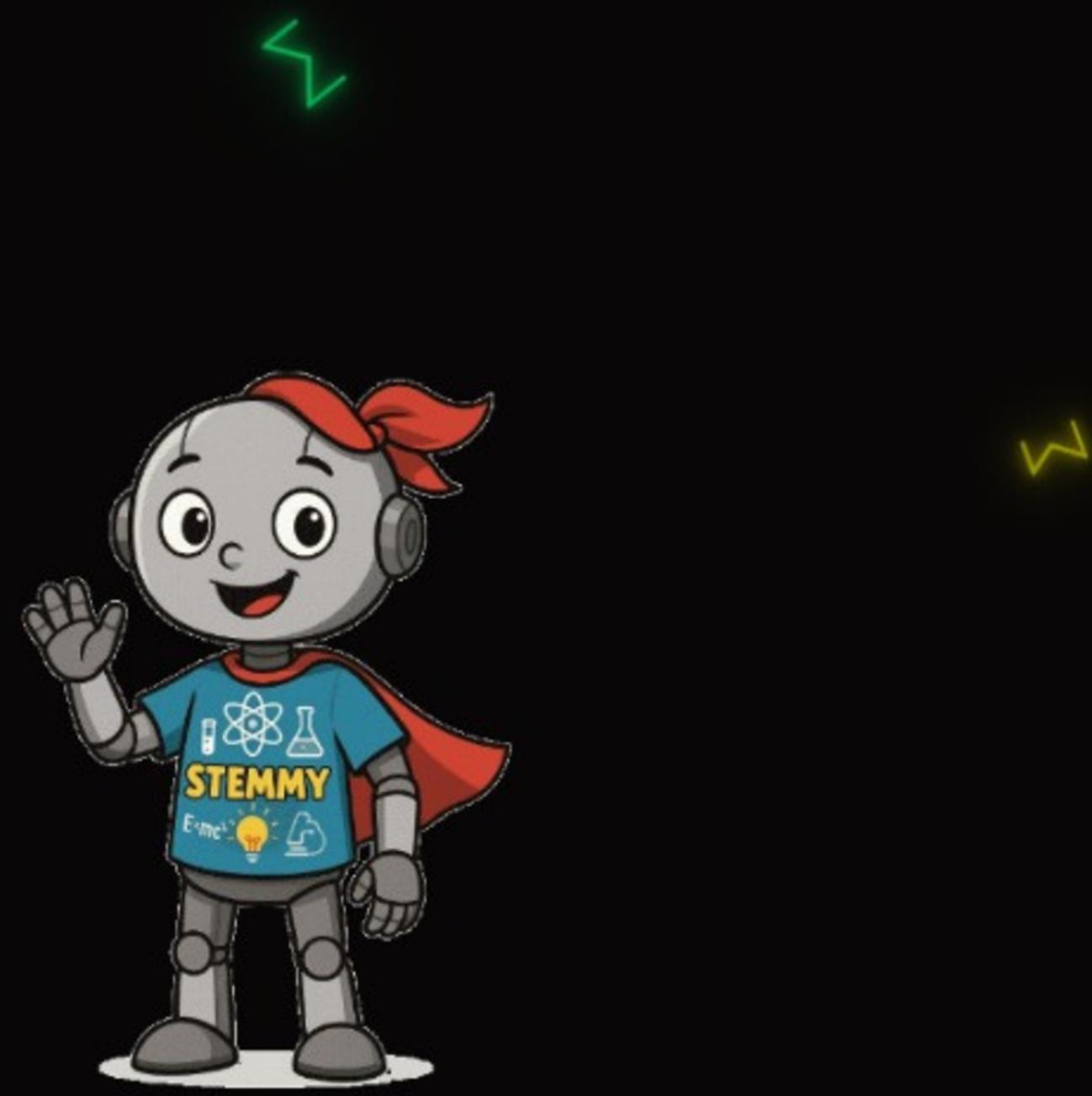
- BERT-based Semantic Understanding
 - Excels at understanding complex STEM queries and context-aware response generation.
- Accuracy: 83.42%

- RAG integration improved contextual relevance and reduced hallucinations.
- Retrieval based on cosine similarity ensured accurate context matching.
- Responses were more precise, coherent, and aligned with user intent.
- Enabled modular and scalable enhancement to the core LLM pipeline.





User Interface



STEMMY Model

Get Started



Hey! How can I help you today? 😊



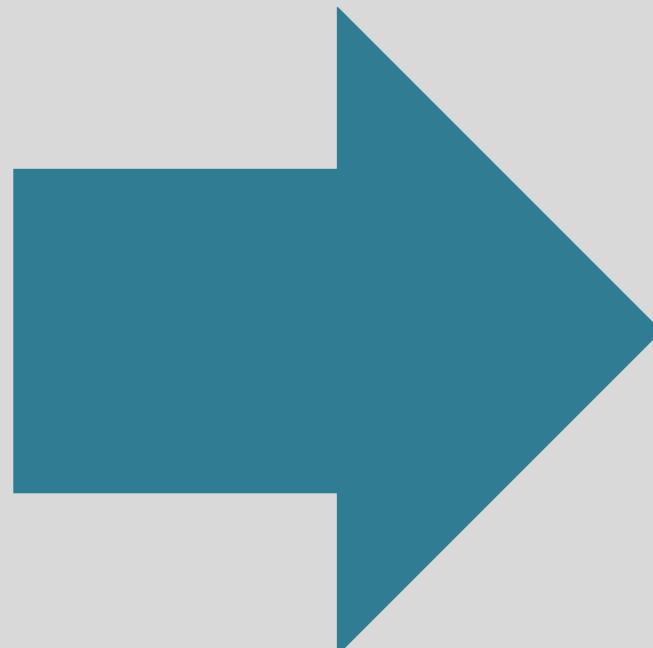
I'd be happy to help you with that! Can you tell me more about the specific concept you're working on?

could you solve integration question?

You

Ask anything



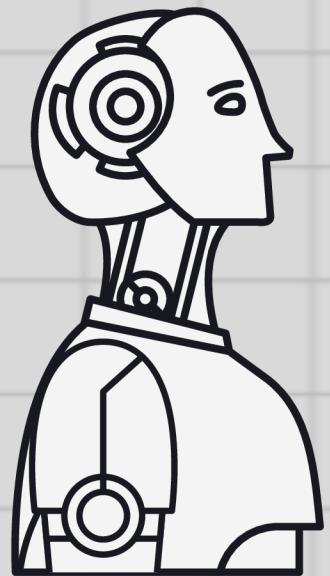


Impact & Future work

Impact

- Promotes inclusive education by supporting students with speech or hearing impairments.
- Enhances engagement in STEM learning through humor and emotional adaptation.
- Bridges the gap between human interaction and AI tutoring, making learning feel more natural.
- Demonstrates the effectiveness of multi-modal AI systems in educational environments.

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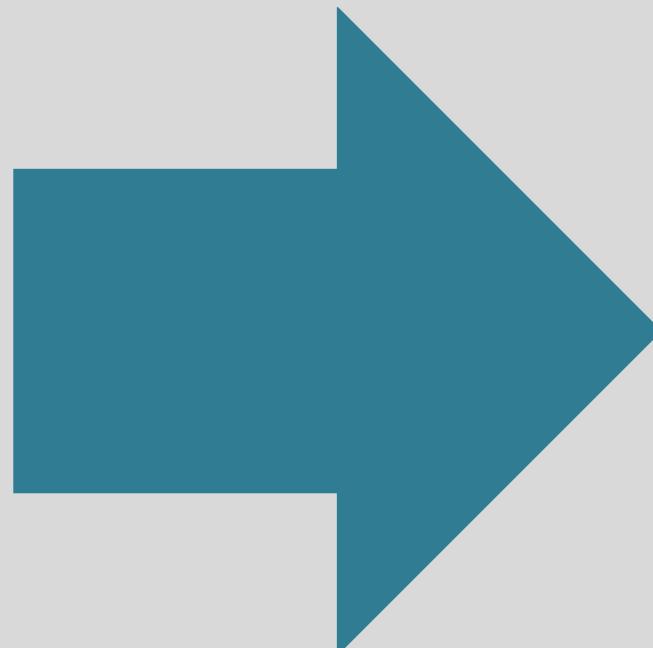
FUTURE WORK

Extend support for Arabic language understanding and response generation

Develop personalized learning paths based on user history and performance

Expand subject coverage beyond STEM to include humanities and social sciences

Enable the AI system to run locally without internet to improve accessibility, speed, and privacy.



Conclusions

CONCLUSION



STEM-CHARM enhances intelligent tutoring by combining technical precision with a user-centered design. It supports complex STEM learning through engaging, personalized interactions using voice, facial expression, and sign language input. This multimodal system boosts accessibility and adapts to users' preferred communication styles for a more inclusive learning experience.

THANK
YOU

