

AI & Accessibility

Technical Guide

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In this guide

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- **Kutti AI: Building a Voice-First Learning Companion for Visually-Challenged Children**

Kutti AI: Building a Voice-First Learning Companion for Visually-Challenged Children

Discover how I built Kutti AI, a voice-first AI-powered learning companion for visually-challenged children, as part of the Half Baked hackathon. Learn about adaptive learning, real-time sentiment detection, and building accessible educational technology.



Learning Through Voice. Learning with Heart.

A free hackathon project that makes education accessible through AI-powered voice interaction

[🔗 Try Kutti AI](#)[🌟 Half Baked Hackathon](#)



The Challenge

When I saw the Half Baked hackathon announcement, I knew I wanted to build something meaningful—something that could make a real difference. The challenge? Create a startup idea that solves a real problem. The solution? Kutti AI: an AI-powered learning companion designed specifically for visually-challenged children. And best of all, it will be completely free.

Traditional educational apps rely heavily on visual interfaces, making them inaccessible to children with visual impairments. Kutti AI flips this paradigm entirely—audio is the primary interface, with no visual elements required. The app teaches curriculum concepts through spoken conversations, listens to the child's voice, detects struggle and frustration in real-time, and adapts lesson difficulty automatically.



Completely Free

Kutti AI will be available as a completely free app with no hidden costs, subscriptions, or in-app purchases. Education should be accessible to everyone, regardless of their financial situation. This commitment to free

access ensures that all children, especially those in underserved communities, can benefit from quality educational technology.

Core Features



Fully Audio-First

Complete voice interaction with no need for visual interface. Every interaction is through speech, making it accessible to all children regardless of visual ability.



Adaptive Learning

Detects struggle through pauses, hesitation, and wrong attempts. Automatically simplifies questions when the child struggles, ensuring they never feel overwhelmed.



Real-Time Feedback

Immediate encouragement and hints when needed. The system recognizes hesitation words like "don't know" and long pauses, providing support at exactly the right moment.



Multi-Language Support

Currently supports English and Tamil, with a flexible architecture that makes adding more languages straightforward. Each language has culturally appropriate content and feedback.

Technology Stack

Building an app that works across platforms while maintaining accessibility required careful technology choices:

React Native (Expo)

Cross-platform mobile development with excellent accessibility support. Expo provides seamless deployment and testing.

Supabase

PostgreSQL database for lessons and progress tracking. Row Level Security ensures data privacy, and real-time capabilities enable future collaborative features.

Whisper.rn

Offline speech recognition using OpenAI's Whisper model. Works without internet, crucial for accessibility in areas with limited connectivity.

expo-speech

Text-to-speech engine for delivering lesson content. Supports multiple languages and voice customization.

expo-av

Audio recording capabilities for capturing child responses. Handles microphone permissions and audio processing.

TypeScript

Type safety throughout the codebase ensures reliability and makes the codebase maintainable as it grows.

How Adaptive Learning Works

The heart of Kutti AI is its adaptive learning engine. It uses three key strategies to detect when a child is struggling and automatically adjusts the lesson:

1. Pause Detection

Measures the time between when a question is asked and when the child responds. If there's a pause longer than 2.5 seconds, the system automatically offers a hint.

```
if (timeSinceLastResponse > 2500ms) { offerHint(); }
```

2. Attempt Tracking

Counts wrong answers. After two incorrect attempts, the system provides a simplified version of the question to help the child succeed.

```
if (wrongAttempts >= 2) { showSimplifiedQuestion(); }
```

3. Sentiment Analysis

Detects hesitation words like "don't know", "not sure", or "help" in the child's speech. When detected, the system provides encouragement and additional support.

```
const hesitationWords = ['don't know', 'not sure', 'help']; if  
(transcript.includes(hesitationWord)) { provideEncouragement(); }
```

Smart Answer Matching

One of the biggest challenges in building a learning app with voice interaction is accurately matching spoken answers to expected responses. Children might say "one" when the answer is "ஒன்று" (Tamil for one), or they might have slight pronunciation variations. Kutti AI uses a sophisticated multi-layered matching system:

1. Language-Aware Matching

The system detects when a child responds in a different language than expected and automatically translates or transliterates for comparison.

```
// Detects language mismatch if (expectedIsTamil && transcriptIsEnglish) {  
// Translate English to Tamil const translated =  
translateToTamil(transcript); // Or transliterate Tamil to English const  
transliterated = transliterateToEnglish(expected); return match(translated,  
expected) || match(transcript, transliterated); }
```

2. Fuzzy Matching

Uses Levenshtein distance to handle pronunciation variations and minor mistakes. This ensures children aren't penalized for slight mispronunciations.

```
function calculateSimilarity(s1: string, s2: string): number { const
editDistance = levenshteinDistance(s1, s2); return (longer.length -
editDistance) / longer.length; } // Accepts matches with >60% similarity if
(similarity > 0.6) return true;
```

3. Normalization

Removes filler words, punctuation, and normalizes whitespace to ensure accurate matching regardless of how the child phrases their answer.

```
// Removes "um", "uh", punctuation, normalizes spacing const normalized =
transcript .toLowerCase() .replace(/^(um|uh|ah|er|hmm)\s+/i, '')
.replace(/[.,!?'-]/g, '') .trim();
```

User Experience Flow

1

Welcome Screen

App automatically speaks a welcome message in the selected language. Large "Start Learning" button with haptic feedback for accessibility.

2

Lesson Begins

Lesson steps are delivered via text-to-speech. Each question is spoken clearly, with natural pauses for the child to process.

3

Voice Recording

Child taps the microphone button (or speaks automatically in auto-mode). Audio is recorded and transcribed using Whisper.

4

Adaptive Response

System analyzes the answer and detects struggle. Provides appropriate feedback: encouragement for correct answers, hints for struggles, or simplified questions when needed.

5

Progress Summary

After completing the lesson, child receives an engagement score (0-100) and encouraging feedback. Progress is saved to the database for tracking.

Database Architecture

Supabase provides the backend infrastructure with a clean, scalable schema:

Lessons Table

Stores curriculum content with JSONB steps containing questions, answers, hints, and simplified versions.

```
{ id: UUID title: TEXT category: TEXT difficulty: TEXT language: TEXT  
  region: TEXT steps: JSONB }
```

Learning Sessions

Tracks individual lesson attempts with engagement scores, correct answers, and struggle moments.

```
{ id: UUID lesson_id: UUID engagement_score: INTEGER correct_answers:  
  INTEGER struggle_moments: INTEGER session_data: JSONB }
```

User Progress

Aggregates learning history with completion counts and average scores for analytics.

```
{ id: UUID total_lessons: INTEGER average_score: DECIMAL completion_count:  
  INTEGER }
```

Accessibility First

Every design decision in Kutti AI prioritizes accessibility:



Screen Reader Compatible

All UI elements have proper accessibility labels and hints for screen readers.



High Contrast Colors

Primary purple (#7A5CFA) and gold (#FFD66B) on black background for maximum visibility.



Large Touch Targets

Minimum 200x200px buttons ensure easy interaction for all users.



Haptic Feedback

Tactile responses for all actions provide confirmation without visual cues.



Audio-Only Mode

Complete functionality available through voice interaction alone.



Adjustable Speech Rate

Future feature to allow children to control how fast content is delivered.

Building for Half Baked Hackathon

The Half Baked hackathon challenged participants to build startup ideas that solve real problems. Kutti AI emerged from a simple observation: educational technology often excludes children with visual impairments. The hackathon format pushed me to think about both the technical implementation and the real-world impact.



Why This Matters

According to the World Health Organization, there are approximately 1.4 million children worldwide with visual impairments. Many of these children lack access to quality educational technology because most apps require visual interaction. Kutti AI bridges this gap by making learning accessible through voice alone. And as a completely free app, it removes financial barriers to access.

 Built for 1.4M+ visually-challenged children worldwide

Technical Challenges & Solutions

Challenge 1: Cross-Language Answer Matching

Children might respond in English when the lesson is in Tamil, or vice versa. The system needed to handle this gracefully.

Solution:

Implemented a translation/transliteration layer that converts between languages before matching. This allows natural language mixing while maintaining accuracy.

Challenge 2: Real-Time Struggle Detection

Detecting when a child is struggling requires analyzing multiple signals: pause duration, wrong attempts, and sentiment—all in real-time.

Solution:

Built a multi-signal detection system that combines temporal analysis (pause detection), attempt tracking, and keyword-based sentiment analysis. The system responds immediately when any signal indicates struggle.

Challenge 3: Offline Functionality

Many children in underserved areas may not have reliable internet access. The app needed to work offline.

Solution:

Used Whisper.rn for offline speech recognition and cached lessons locally. Progress syncs when internet is available, but the core learning experience works completely offline.

Future Enhancements

While Kutti AI is fully functional, there's always room to improve. Here's what's next:

Planned

More Languages

Expand beyond English and Tamil to support Hindi, Spanish, and other major languages.

Planned

Parent Dashboard

Web interface for parents to track their child's progress and see detailed analytics.

Planned

Gamification

Add rewards, badges, and achievements to make learning more engaging.

Planned

Teacher Tools

Allow educators to create custom lessons tailored to their curriculum.

Conclusion

Kutti AI represents what's possible when we prioritize accessibility and user experience. By building a learning companion that will be completely free, we're not just creating an app—we're opening doors to education for children who have been left behind by traditional educational technology.

The Half Baked hackathon provided the perfect opportunity to validate this idea and build a working prototype. The response has been overwhelmingly positive, and I'm excited to continue developing Kutti AI to reach more children worldwide.

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