

LusoPronounce

An AI-Driven Portuguese Pronunciation Coach

Built by: T. Galloway

Core Tech Stack

Next.js

TypeScript

Azure AI Speech

Custom Linguistic Metadata

Supabase

The Ambiguity of Pronunciation Practice



1. Invisible Mechanics

Learners struggle with concepts that don't exist in their native language, like distinguishing nasal vowels (pão), open vs. closed vowels (avó/avô), or the different 'R' sounds.



3. Lack of Structure

Without a clear path, practice is inconsistent and learners don't know which sounds to focus on.



2. Vague Feedback

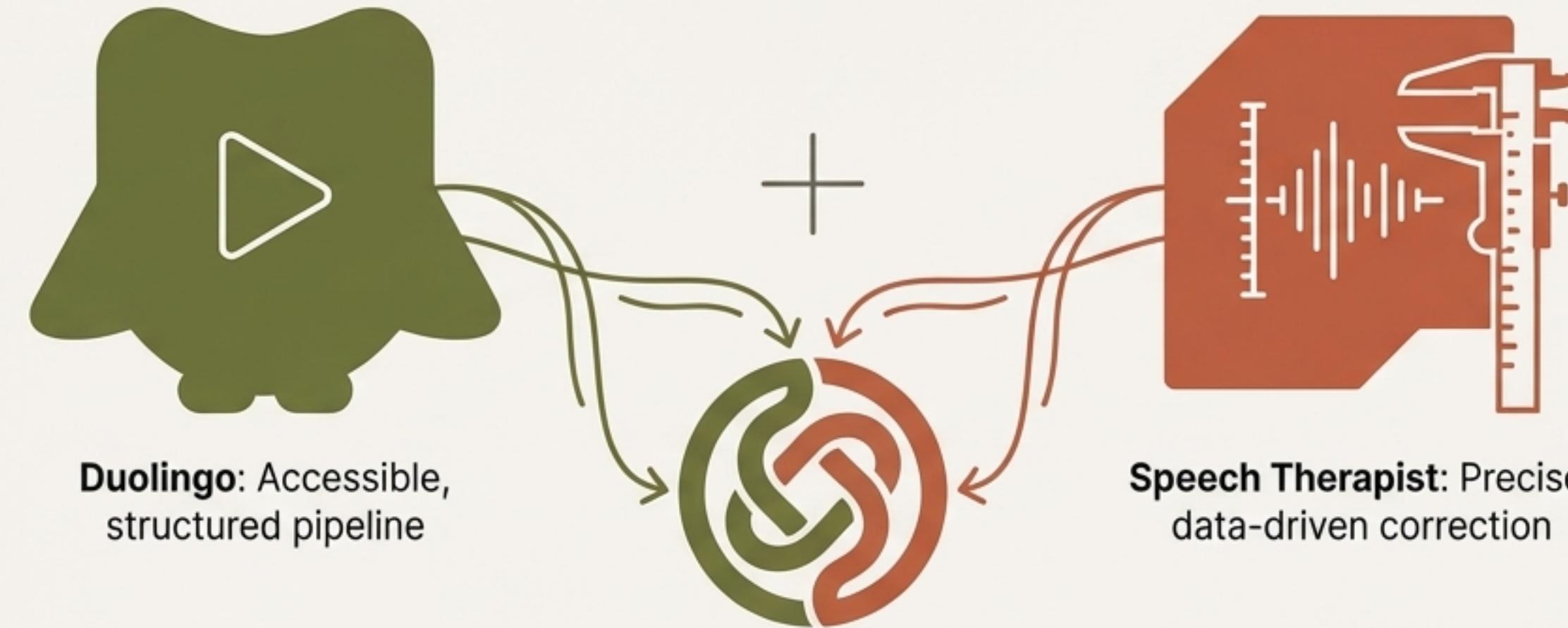
Standard feedback is often limited to a binary 'good' or 'bad,' without explaining **why** it was wrong or **how** to fix it.



4. Inauthentic Material

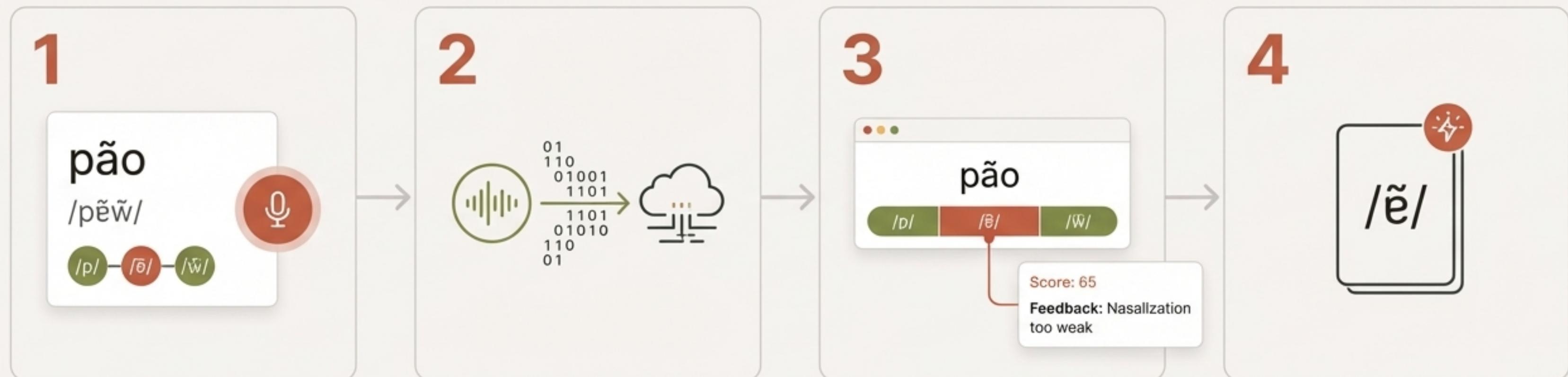
Difficulty finding consistent examples of authentic Brazilian Portuguese speech for specific sounds.

The Vision: Engineering a Personal Speech Therapist



- ✓ Evaluates pronunciation with phoneme-level scoring.
- ✓ Explains errors with IPA and articulatory cues.
- ✓ Surfaces weak phonemes in a personalized dashboard.
- ✓ Generates smart flashcards targeting specific weaknesses.

A User's Journey: From 'pão' to Perfect Pronunciation



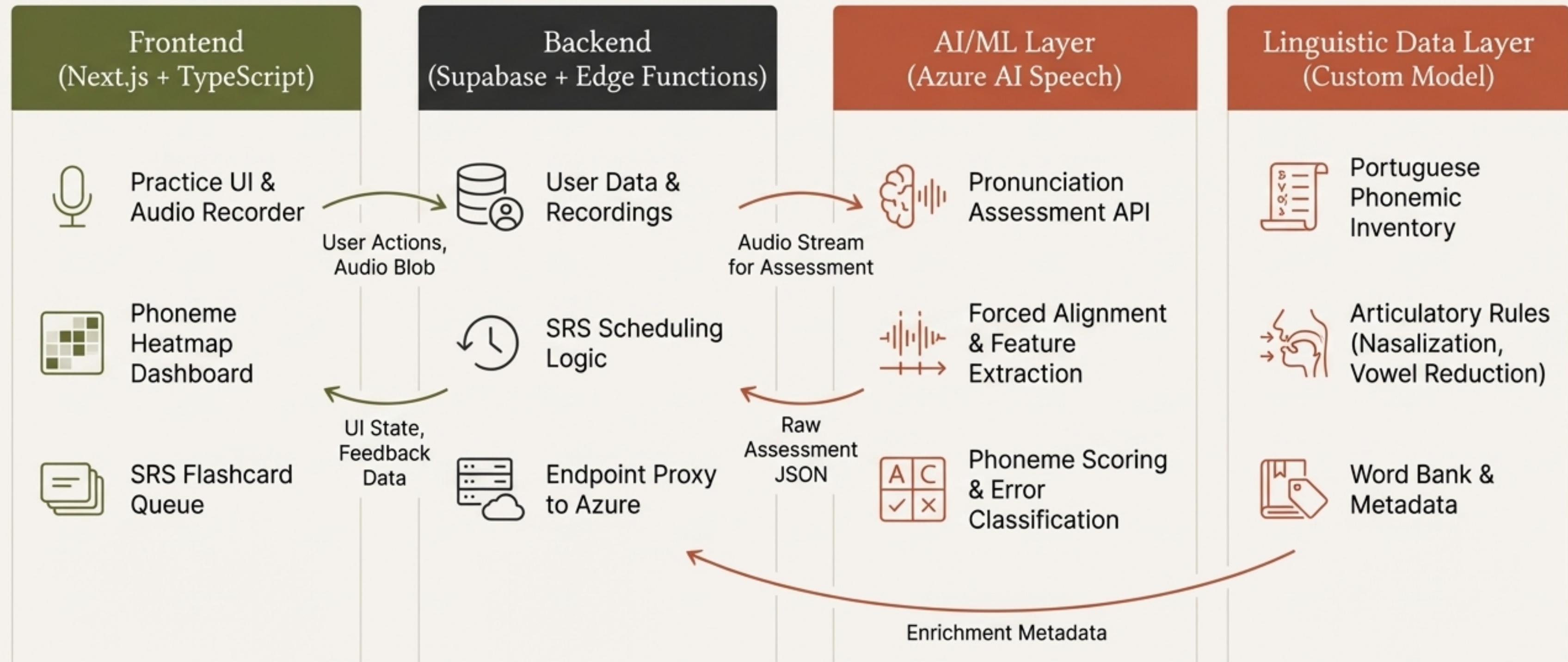
User selects a word and records their pronunciation.

Audio is securely processed by the AI layer.

Phoneme-level scores and feedback are displayed instantly.

A new SRS card is created to target the specific weakness.

The LusoPronounce System Architecture



Enhancing AI: From Raw JSON to Actionable Coaching

Azure's Raw Assessment

```
{  
  "phonemes": [  
    {  
      "phoneme": "/ɛ/",  
      "score": 65,  
      "errorType": "nasal-too-weak"  
    },  
    ...  
  ]  
}
```



LusoPronounce's Enriched Feedback

/ɛ/



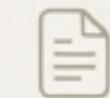
Error Detected
Nasalization too weak.

Corrective Cue
Let more air flow through your nose. Try to
feel a vibration.

Our IPA-Corrective Logic Layer maps raw scores and error types to a rich set of custom categories (Nasal Vowel, Open Vowel, Tap R) and generates specific, actionable advice.

The Linguistic Foundation: A Custom Model for Portuguese

1. Custom Phonemic Inventory



A comprehensive inventory of Brazilian Portuguese sounds.

- 7 Oral Vowels, 5 Nasal Vowels, 19 Consonants
- Key Allophones Modeled: Tap R /ɾ/, Guttural R /ʁ/, Palatalization of /t/ → /tʃ/ and /d/ → /dʒ/.

2. Data-Driven Rules Engine

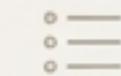


Models complex phonetic rules and critical distinctions.

- Vowel reduction in unstressed syllables.
- Regional variations like the retroflex R /ɻ/.
- Minimal pair data (e.g., avó vs. `avô).

3. Rich Word Metadata

```
{  
  "word": "pão",  
  "ipa": "/pe̯ā/",  
  "phonemes": [  
    {  
      "symbol": "ẽ",  
      "features": {  
        "nasal": true,  
        "openness": "mid"  
      }  
    }  
  ],  
  "focusPoints": [  
    "nasalization",  
    "diphthong"  
  ]  
}
```



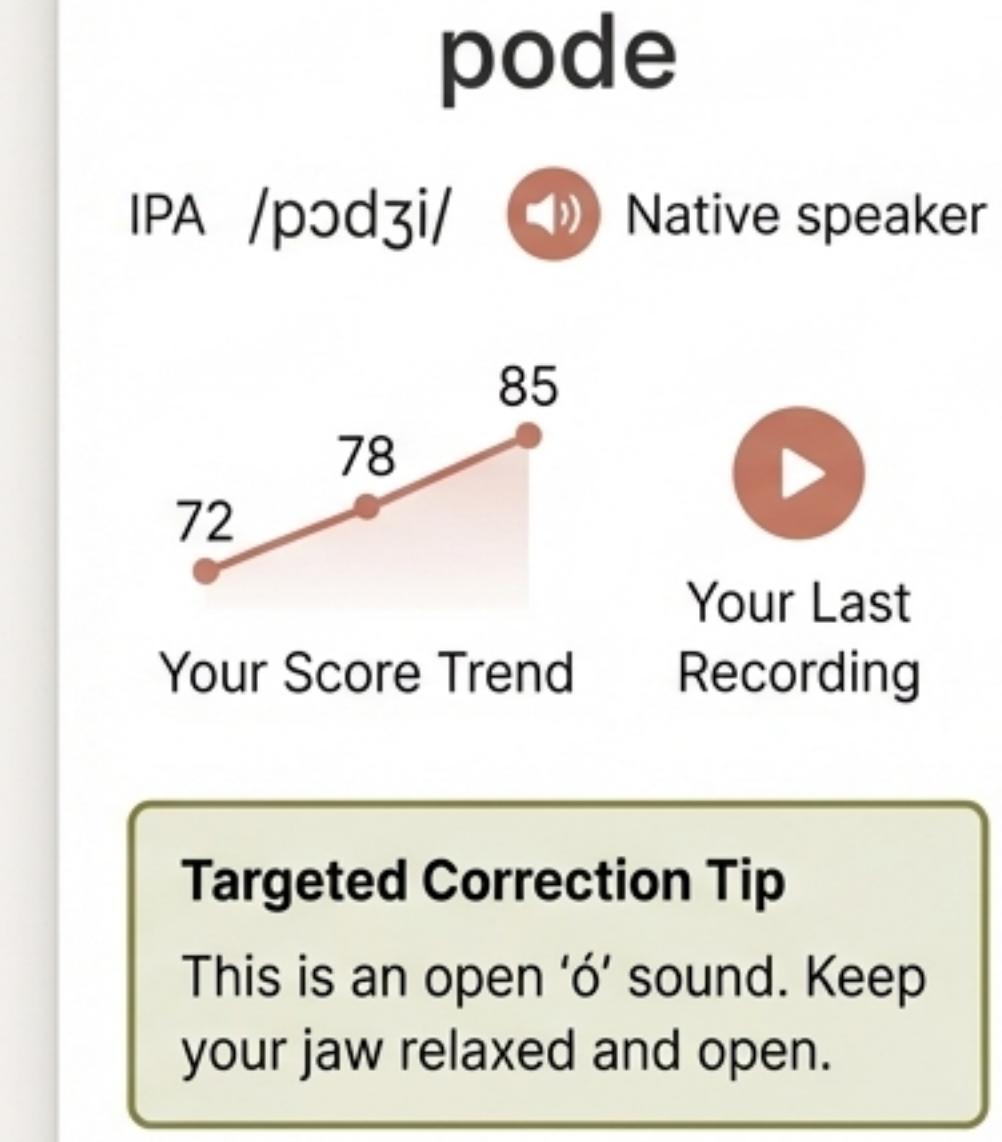
Smart SRS: An Adaptive System for Long-Term Retention

A Pronunciation-Aware Algorithm

A customized SM-2 (Anki) algorithm where interval scheduling is weighted by more than just pass/fail.

Weighting Factors:

- 🎯 Phoneme Accuracy Score
- ⏸️ Historical Error Frequency
- ⌚ Time Since Last Practice
- ⭐ Word/Phoneme Difficulty Rating



From ‘What’ to ‘How’: The Error Explanation Engine

The system maps `[Phoneme + Error Type]` to a library of corrective coaching cues.

Error Detected: Poorly scored Tap R /r/

Coaching Cue Provided: A single, light tap of the tongue tip against the roof of your mouth — think of the 'tt' in the American English word 'butter'.

Error Detected: Low score on a closed vowel like /e/ in 'você'

Coaching Cue Provided: Tighten the tongue root and raise the vowel slightly. Your mouth should be less open than for the 'e' in 'bed'.

Error Detected: Weak nasalization on /ẽ/ in 'mãe'

Coaching Cue Provided: Lower your soft palate slightly. Let air flow through both your nose and mouth to create the nasal quality.

A Data-Rich UI Designed for Clarity and Motivation

Design Philosophy

Visual-first, low cognitive load.

Strong audio and color feedback over dense text.

Game-like progression without distracting gamification.

The image displays three screenshots of a mobile application interface designed for language learning, emphasizing clarity and motivation through data visualization and audio feedback.

Screenshot 1: Vowel Practice

This screen shows a vowel chart with nine slots arranged in a 3x3 grid. The slots are colored in a gradient: top row (orange, red, green), middle row (light orange, light red, orange), bottom row (red, green, orange). The slot at position [1, 2] (top-left) contains the symbol '/ã/' with a red exclamation mark icon above it. A small red triangle points to this slot from a callout box below. The callout box contains the text "Targeted Correction Tip" and the instruction "Nasalize the vowel more strongly for the 'ão' sound."

Screenshot 2: Word Pronunciation

This screen displays the word "pão" with its phonetic transcription "/pẽ̃w/" and a speaker icon. Below the word is a green waveform visualization. To the right is a 3x3 grid of vowel symbols: /a/, /e/, /i/ in the first column; /o/, /u/, /ã/ in the second column; and /ɛ/, /r/ in the third column. The slot containing '/ã/' is highlighted with a red background.

Screenshot 3: Progress Monitoring

This screen shows a line graph titled "Progress for /ã/". The vertical axis is labeled "Accuracy" with markers at 0%, 50%, and 100%. The horizontal axis is labeled "Time (30 days)" with markers for Day 1, Day 10, Day 20, and Day 30. A green line with circular markers tracks the user's accuracy over time, showing a steady increase from approximately 35% on Day 1 to nearly 100% by Day 30.

The Roadmap: From a Product to a Universal Framework

Short-Term

- Sentence-Level Pronunciation Assessment
- Adaptive Difficulty Leveling
- Spectrogram Comparison View

Medium-Term

- Support for European Portuguese
- Conversational Repair Drills
- User-Generated Wordlists

Long-Term

- **The Ultimate Goal:** A generalized engine to become a Universal Pronunciation Tutor for any language.
- API for integration with other language apps.
- Fine-tuning ML models on collected learner audio.

Demonstrated Capabilities: A Synthesis of Engineering and Product

What was built

Integrated advanced Speech Recognition AI (Azure).

Developed a custom phonetics and linguistics model.

Engineered an adaptive learning algorithm (SRS).

Designed a UX focused on habit-formation and clarity.

Built a full-stack, end-to-end application.

What this proves

****End-to-End Architecture**:** Ability to design and execute a complex system from frontend to data layer.

****Practical AI Implementation**:** Skill in leveraging a powerful AI service and, crucially, enhancing its value with custom logic.

****Deep Domain Modeling**:** Meticulous data work and linguistic knowledge beyond just plugging in an API.

****User-Centric Product Thinking**:** A clear focus on solving a real user problem with an elegant and effective solution.