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TechSprint

Leveraging the power of AI

Team Details

a. Team name: DevStack
b. Team leader name: Akshat Raikar
c. Problem Statement: Open Innovation

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Brief about your solution and problem statement addressing

PROBLEM STATEMENT:

466 million people worldwide are deaf or hard-of-hearing, facing daily communication barriers. Current solutions are expensive ($50-150/hour interpreters), require special hardware, or have limited vocabularies. Learning sign language takes months, leaving the deaf community isolated in education, healthcare, employment, and social settings.

SOLUTION:

SignSpeak is a FREE, browser-based AI sign language translator using only a webcam. Built with Google's MediaPipe, Gemini AI, and Firebase, it provides real-time bidirectional translation (sign-to-text AND text-to-sign) with 13 signs supported. Features include voice output, dual AI detection, and cloud storage. No installation, no hardware, no cost—just instant accessible communication for 466M+ individuals worldwide.

Opportunities

a. How different is it from any of the other existing ideas?

SignSpeak is completely FREE and browser-based (no app installation), unlike paid competitors like SignAll or ASL App ($9.99/month). It requires only a webcam, not expensive hardware like Kinect ($500+). Our dual AI system (MediaPipe + Custom Heuristic) supports 16 signs with higher accuracy than most free solutions (5-7 signs). We offer bidirectional translation (sign-to-text AND text-to-sign), while competitors typically only do one direction.

b. How will it be able to solve the problem?

SignSpeak provides instant communication without waiting for interpreters, reducing time from hours to seconds and cost from $50-150/hour to zero. Real-time translation enables natural conversation flow in critical situations like hospitals and emergencies. The text-to-sign feature helps users learn sign language instantly instead of months of training. Being cloud-based on Firebase, it scales to unlimited users globally with <100ms latency. This breaks down barriers in education, healthcare, employment, and social interactions for 466M+ deaf/hard-of-hearing individuals worldwide

List of features offered by the solution

1. Sign-to-Text Translation -Instant conversion of detected signs to readable text with 4-second smart buffering and 5-second cooldown between same signs
2. Text-to-Speech Output - Automatic voice narration of translations for enhanced accessibility and real-time communication
3. Text-to-Sign Guidance - AI-powered learning feature that converts text input into step-by-step sign sequence instructions
4. Interactive Sign Library - Searchable database with detailed descriptions, category filters, and visual guides for all 13 supported signs
5. User Authentication - Secure one-click sign-in with optional authentication
6. Gesture Scroll Navigation - Innovative hands-free webpage scrolling using palm up/down gestures for enhanced accessibility
7. Performance Optimizations - Lite MediaPipe model,~30 FPS performance for smooth real-time detection

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Google Technologies used in the solution

1. MediaPipe Hands - Real-time hand landmark detection and 21-point hand skeleton tracking for accurate finger position recognition
2. MediaPipe Gesture Recognizer - Pre-trained AI model for gesture recognition (YES, HELLO, etc.)
3. Google Gemini 1.5 Flash - Large Language Model API for intelligent text-to-sign guidance and translation
4. Firebase Hosting - Global CDN for fast web application delivery with automatic SSL/HTTPS and 99.9% uptime
5. Firebase Authentication - Secure Google OAuth integration for user sign-in and session management
6. Google Material Design - Design system and UI guidelines with Material shadows, elevation, and Google's color palette
7. TensorFlow.js - Client-side machine learning framework for browser-based AI inference in the heuristic classifier
8. Chrome WebRTC - Browser API for real-time webcam access and video streaming

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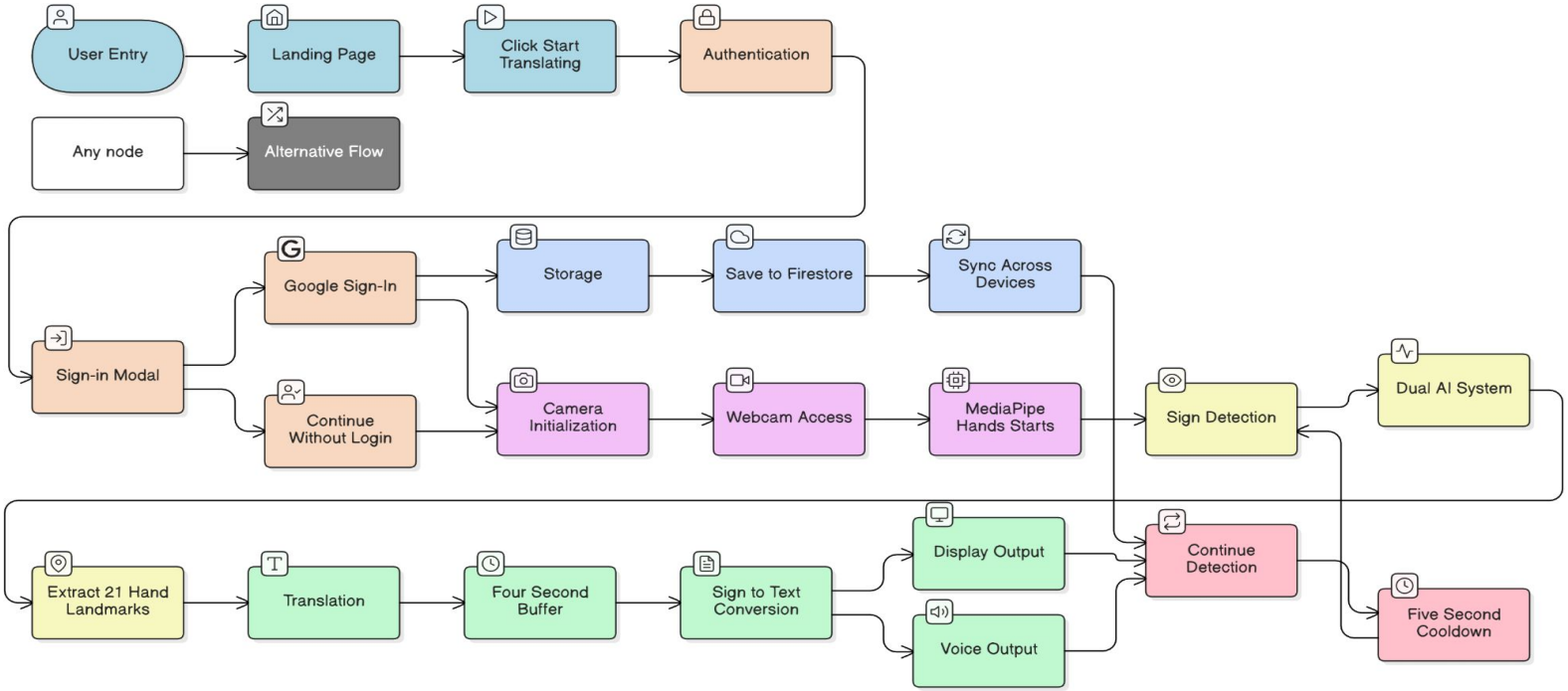
Process flow diagram or Use-case diagram



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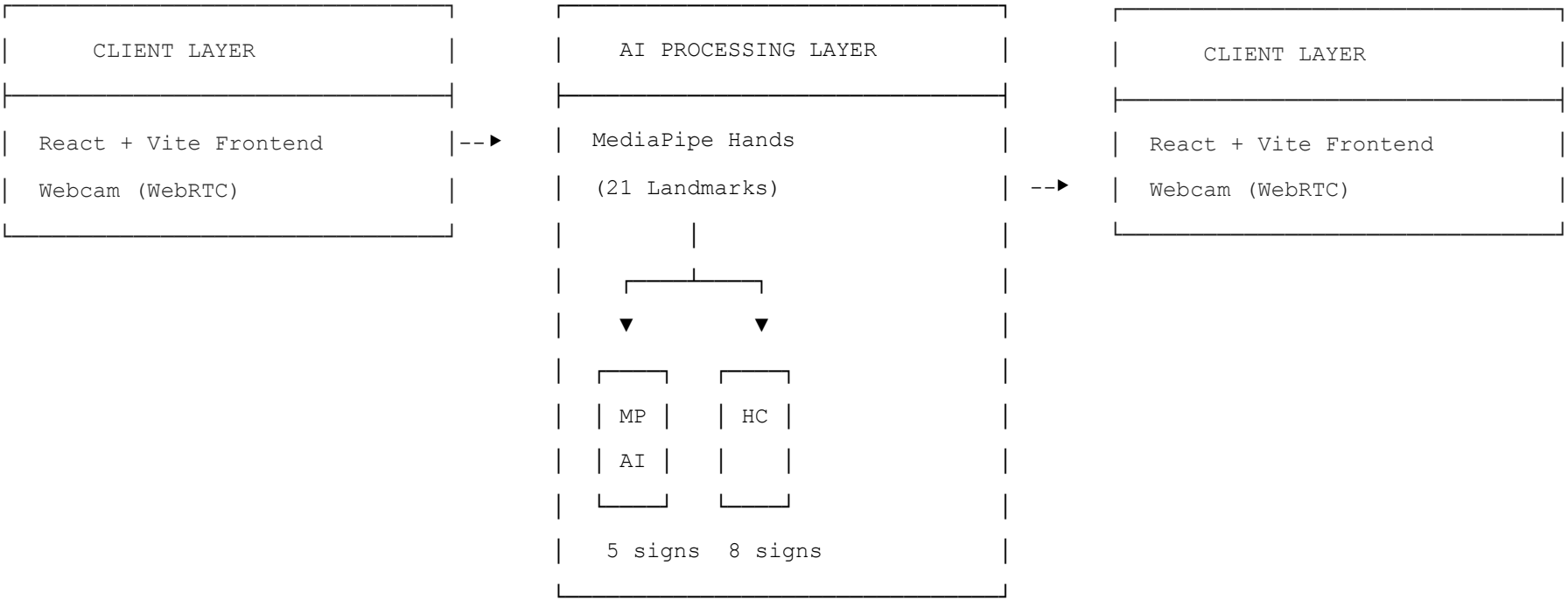
Architecture diagram of the proposed solution



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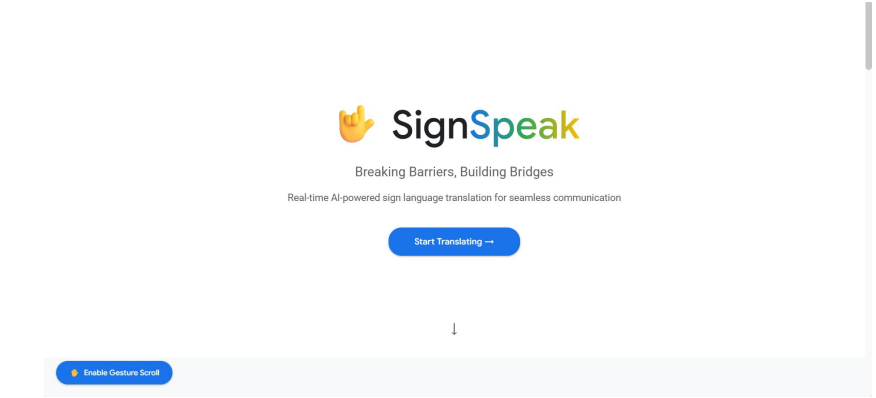
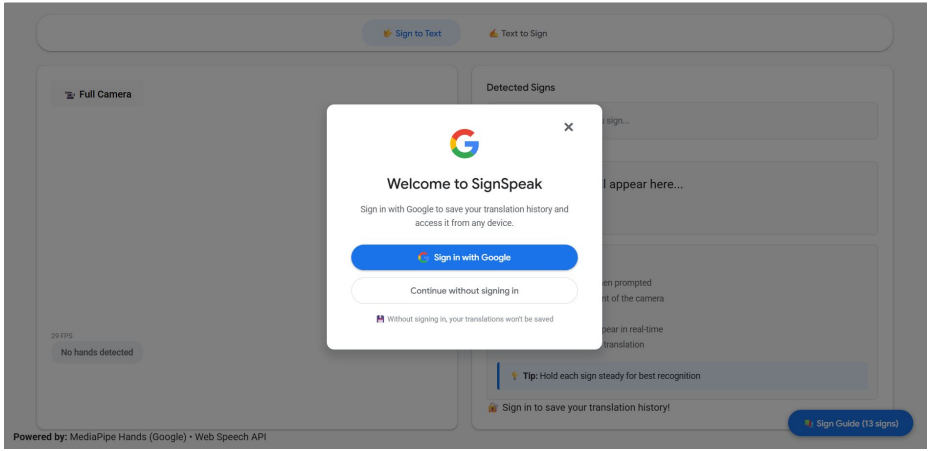
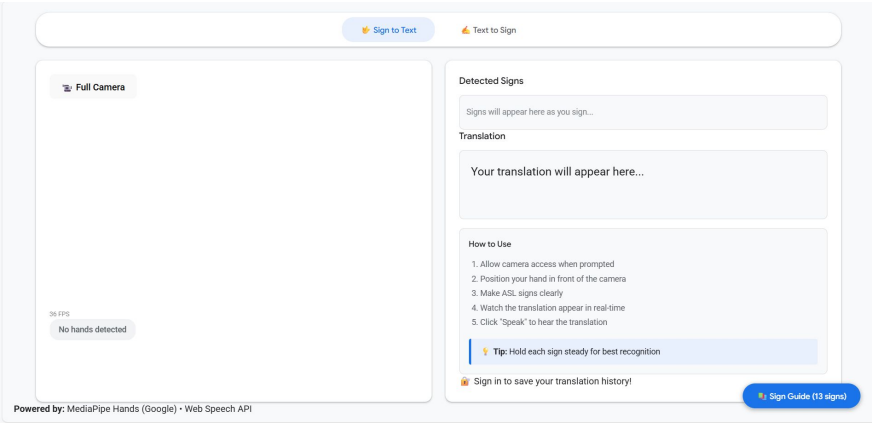
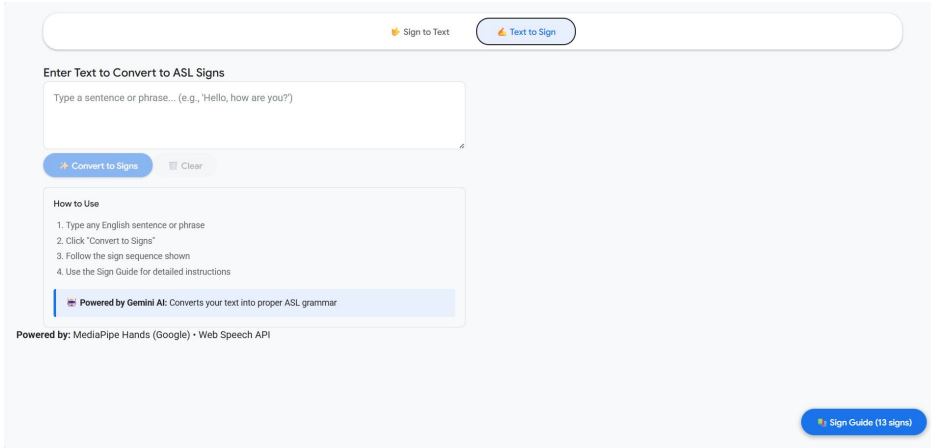
Snapshots of the MVP









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Additional Details/Future Development

Phase 1 - Expanded Library:

- Full ASL alphabet (A-Z)
- Numbers 6-100
- 50+ common phrases

Phase 2 - Advanced AI:

- Grammar correction
- Emotion detection
- Multiple sign languages (ASL, BSL, ISL)
- Two-way conversation mode

Phase 3 - Mobile Apps:

- iOS & Android native apps
- Offline mode
- PWA support

Phase 4 - Enterprise & Learning:

- Video call integration (Zoom, Meet)
- Interactive courses with gamification
- API for third-party apps
- Custom organizational dictionaries

Phase 5 - Global Expansion:

- Multi-language UI
- International sign language support
- Partnerships with deaf organizations
- Educational licenses

1. **GitHub Public Repository-** https://github.com/akshatraikar11/SignSpeak
2. **Demo Video Link (3 Minutes)-** https://drive.google.com/file/d/19cn2n1_DV9xLj4IGhYy4xnyy4rdG0D2N/view?usp=sharing
3. **MVP Link-** https://signspeak-devstack.web.app/